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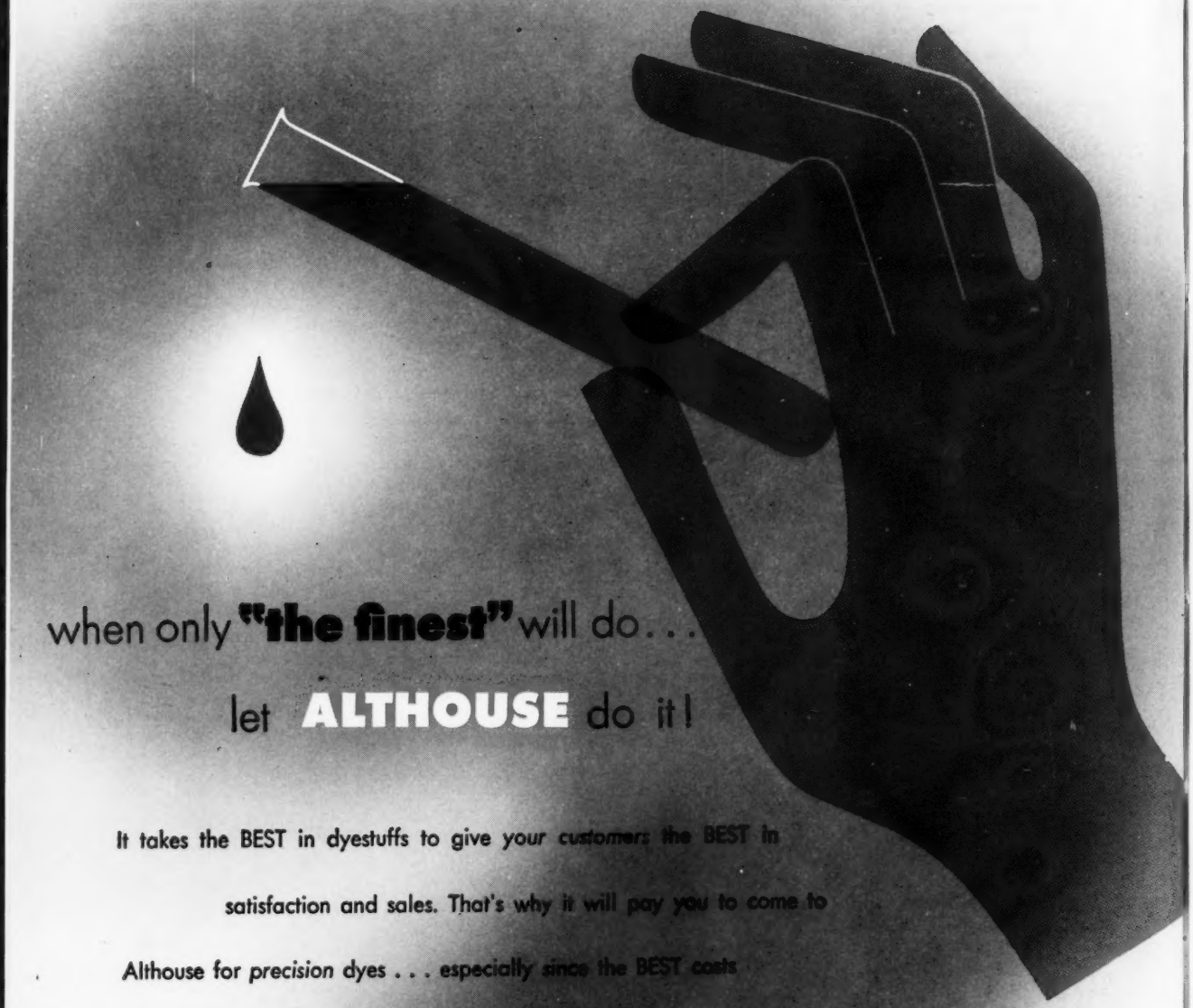

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AMERICAN
DYESTUFF REPORTER

VOLUME 41 MARCH 17, 1952 NUMBER 6

X-51* Acrylic Fiber

AT a meeting of the American Association of Textile Technologists, held on March 5th at the Builders' Club, New York, N Y, the American Cyanamid Company introduced its new acrylic fiber, designated as X-51 acrylic fiber. Dr A Cresswell discussed physical and chemical properties, C W Bendigo spoke on spinning, weaving and knitting, and Dr A L Peiker outlined scouring, dyeing and finishing. The papers by Drs Cresswell and Peiker follow.

PHYSICAL AND CHEMICAL PROPERTIES

DR A CRESSWELL
American Cyanamid Company

THE presentation by the American Cyanamid Company of its new acrylic fiber, presently designated as X-51 acrylic fiber, points up the fact that with the rapid developments in this field 1952 may well be called an acrylic year.

It is my privilege in this discussion to present the physical and chemical properties of the fiber as representative of the material which is being produced on a pilot-unit scale at Stamford, Conn. It will be understood that we are still accumulating test data, but the objective of this presentation is to give textile men, including mill technicians, a general survey of the fiber properties.

X-51 acrylic fiber is, in common with others of its type, a fiber that is based on acrylonitrile as a raw material. It is produced in two forms, namely, crimped staple and continuous filament, each of which has physical properties which may differ from those of the other.

COLOR—The color of the fiber is near-white, that of the staple being a bluish-white while that of the continuous filament yarn has a slight yellow tint. It has been shown that the fiber can be further bleached if desired.

LUSTER—The luster of both staple and continuous filament can be described as naturally semi-dull, the staple being slightly less lustrous than the continuous filament. When examined microscopically, both forms have a fairly smooth surface. The continuous filament appears optically nearly clear, while the staple presents a slightly hazy appearance.

A Cresswell

CROSS-SECTION—The cross-section of X-51 acrylic fiber is substantially circular in both staple and continuous filament forms. Both forms exhibit a certain skin effect, this being somewhat more pronounced in the continuous filament. The cross-section shape is distinctive from the other acrylic fibers which are presently available. Other properties which are of interest to the microscopist is the approximate refractive index of 1.51; birefringence is relatively low.

SPECIFIC GRAVITY — The specific gravity of a fiber is a matter of both economic and aesthetic interest to the mill man and textile designer. The true specific gravity of X-51 acrylic fiber as determined by buoyancy in liquids is approximately 1.17 for both staple and continuous filament; the former being slightly over and the latter slightly under this average. However, it is of great practical interest to note at this point that the apparent density of staple in air is appreciably lower than the true specific gravity would indicate; this is evidenced by a greater cross-sectional area, i.e. greater bulkiness, than would be expected from the true specific gravity.

STICKING TEMPERATURE—The incipient melting point or sticking temperature of X-51 acrylic fiber is about 560° F as determined on a hot surface. However, the fiber shrinks and shrivels below this temperature, in common with other thermoplastic fibers.

MECHANICAL PROPERTIES — We now come to the mechanical properties of the fiber as determined by stress and strain relationship. Taking X-51 continuous filament first, we find an average dry tenacity of about 3.6 grams per denier with an elongation of about 22%. This is determined with yarn having a filament denier of 1.66. The stress-strain curve exhibits a definite knee or yield point of about 1.2 grams per denier and elongation of about 2%. The modulus as given by the first slope of the stress-strain curve is about 60 grams per denier and the stretch resistance at 2% elongation is 1.1 grams per denier. This shows that the continuous filament yarn has a fairly firm hand and also rather good resistance to deformation under stresses associated with fiber handling. The one-minute recovery from 2% stretch is 95% complete from instantaneous release and 71% after 100 seconds of holding under tension. Longer periods permit even more recovery. The wet tenacity of continuous filament is about 3.2 grams per denier with an elongation of about 22%, which is not greatly different from dry yarn. The knot and loop tenacities are 2.0 and 2.8 grams per denier, respectively; the loop elongation, an important property in determining knitting properties, is about 18%.

X-51 acrylic fiber staple has mechanical properties which differ in many respects from those which have just been given for continuous filament. The dry tenacity, as determined by single filament tests of 3 denier staple, is about 2.5 grams per denier with an elongation of about 27%. The stress-strain curve shows a knee or yield point at about 0.8 gram per denier

* Trade-Mark of American Cyanamid Company for its acrylic fiber.

with an elongation of about 5%. The modulus as given by the first slope of the stress-strain curve is about 40 grams per denier and the stretch resistance at 2% elongation is 0.5 gram per denier. The staple, like filament, shows a rather good resistance to deformation under stresses induced by textile handling. The one-minute recovery from 2% stretch is 92% complete from instantaneous release and 53% after 100 seconds of holding under tension. These recoveries also increase with longer time. For 1.5 denier staple the corresponding properties are slightly higher. In general, it can be said that X-51 acrylic staple has good physical properties for the requirements of textile processing.

RESISTANCE TO EXPOSURE—Resistance to outdoor exposure, involving radiation, moisture, changes in temperature and so forth is exceptionally good. One year direct exposure in Florida of continuous filament yarn showed a retention of 60% of its initial tenacity and elongation, while the loop and knot properties were affected still less. Under glass, the percent retention of initial properties was higher. Similar tests are presently going on for staple. The initial tests reported were for filament yarn containing antistatic finish. We believe that current tests being made without finish will show even better results.

ELECTRICAL PROPERTIES — The electrical properties of X-51 acrylic fiber are, in common with other fibers, dependent to some extent on moisture conditions. At relative humidities up to 50% the resistance is 450,000 megohms; the equilibrium moisture in the fiber at 50% relative humidity is about 1.1%. Above this point the resistance drops rather quickly.

DIMENSIONAL STABILITY — The dimensional stability of X-51 acrylic fiber as determined by relaxation shrinkage is good. Staple is produced with a stabilized crimp which withstands boiling water; furthermore, no fiber shrinkage takes place. Continuous filament yarn in general will show shrinkage of less than 2% in boiling water and has been produced with no residual shrinkage. In common with other thermoplastic fibers, X-51 acrylic fiber shrinks at high temperatures with loss of tenacity; however, it can be pointed out that exposure of continuous filament yarn to a temperature of 275°F for 6 hours gave no change in physical properties when tested at room temperatures.

FLAMMABILITY—In view of the current interest in flammability of fabrics and fibers, it is apropos to comment on X-51 acrylic fiber. Being thermoplastic, it melts and may ignite when an open flame is applied; in general, cigarette ash will not cause pinholes, and glowing embers will not ignite fabrics produced from staple.

RESISTANCE—Resistance to attack by insects or by mildew and other microorganisms is excellent. The black carpet beetle, which is well known for its reproducible damage to wool, starved to death when given only fabric constructed of X-51 acrylic fiber. Soil burial test of fabric in the severe ASTM vertical method showed no change after six weeks' exposure to soil microorganisms.

We now come to the solvent and chemical resistance of X-51 acrylic fiber. Due to the exceptional solvent resistance of polymers comprising principally acrylonitrile, X-51 acrylic fiber is neither dissolved nor softened by the usual organic solvents such as hydrocarbons, alcohols, esters, ketones, ethers or chlorinated hydrocarbons.

Chemical resistance is of great importance in determining not only the general utility of a fiber but also the conditions under which fabrics can be handled in dyeing and finishing. In general, it can be said that resistance to acids is very good, with a tendency to bleach, while resistance to alkalis is fair to good with a tendency to yellow under severe conditions. Higher concentrations and higher temperatures cause more severe attack. For example, two months' exposure of continuous filament yarn to 40% sulfuric acid at 122°F showed a retention of more than 75% of the initial tenacity, while at the same temperature 1% caustic soda effected about the same attack in one month. In general, it can be said that under normal alkaline conditions, such as encountered in vat dyeing, no appreciable loss in tenacity or color should be expected.

In conclusion, I would like to sum up the physical and chemical properties of X-51 acrylic fiber by saying that it presents properties which will permit a wide utility, ranging from aesthetic apparel to rugged industrial applications.

SCOURING, DYEING, AND FINISHING

DR A L PEIKER
American Cyanamid Company

THE physical and chemical properties which were described by Dr Cresswell are exceedingly important properties of X-51 acrylic fiber. These properties are especially important to the textile engineer or fabric designer because they indicate fiber blends, yarn counts, fabric designs, and the myriad of other items that go into new fabric development. There is, however, another facet to X-51 acrylic fiber that is equally important. This deals with the dyeing properties.

For convenience, the discussion on the dyeing properties will be divided into two parts, namely, (1) staple and (2) continuous filament.

STAPLE

SCOURING — One of the important properties of X-51 acrylic staple is the clean whiteness of the fiber itself. It is advisable that all preliminary processing of the fiber be carried out in a manner designed to avoid discoloration. Since X-51 is made from a polymer of acrylonitrile, it has a property that is common with all acrylic fibers, namely, exposure to alkali at high temperatures and for prolonged periods of time will cause yellowing. This yellowing can be prevented by reasonable care in processing, and if yellowing does occur, it can be corrected by subsequent treatments.

X-51 can be subjected to normal wool scouring procedure to produce a good clean bottom. For example, it has been scoured for 15 minutes in a 30:1 bath containing 1% soda ash and 0.5% soap at 120°F to produce a clean white fabric. Temperatures in excess of 140°F and scouring times in excess of 30 minutes at 120°F should be avoided. If, however, due to machine stoppages or faulty temperature controls, excessive times or temperatures occur, the original whiteness can be restored by an acid rinse. It has been found that repeated home launderings do not materially change the color of the fiber.

Another general method for scouring X-51 acrylic staple that has produced good results is as follows: The fabrics or yarns are boiled for 15 minutes in a 30:1 bath made up of 0.25% Deceresol OT Wetting Agent containing 0.1% of glacial acetic acid. Other wetting agents and detergents that have been successfully used in this scouring process are Duponol WA, Nacconol, and Deceresol 22 Wetting Agent. This procedure will produce a good clean bottom with no yellowing. The time and temperature of processing are not critical, since no changes in the color of X-51 have been noted at any time. A pH range of from 3.5-5.5 is recommended, although pH's up to 7 can be tolerated.

X-51 acrylic staple can be dyed with the following classes of dyes: acetate, acid and direct, basic, vat, and soluble vat. These will be discussed in that order. It must be pointed out at this time that the information on dyeing is based almost entirely on laboratory studies.

ACETATE DYES—Staple can be dyed with practically all acetate dyes. The dyeing procedure is quite simple. The acetate dyes are dispersed in water alone. The

use of dispersing agents, e g, Duponol WA, soaps, etc, is not recommended. The dyeings should be made at temperatures as close to the boil as is practical. Temperatures below 200°F should be avoided. At such temperatures, dyeing times of from one to one and one-half hours are required.

In general, the dyeing time may be reduced and the fastness properties, at equal depths of shade, improved by increasing the dyeing temperatures. Excellent dyeings have been made in 20 minutes on packages and raw stock in a one-package laboratory machine, under pressure, at temperatures between 230° and 250°F. The depth of shade per unit of dye and fastness properties were improved materially. While this dyeing technique shows real promise, there is one note of caution. The packages must be very soft and evenly wound.

As a class, these dyes show good build-up properties and heavy shades can be obtained. At equal depths of shade, the light fastness is about equivalent to that on nylon staple, the fastness to washing is comparable, and the crocking is negligible.

ACID AND DIRECT DYES — When dealing with most hydrophobic fibers, the classical division between acid and direct dyes is not clearly drawn. Using the so-called "cuprous ion" method, most acid and milling dyes and a surprising number of direct dyes can be applied to X-51 acrylic fiber.

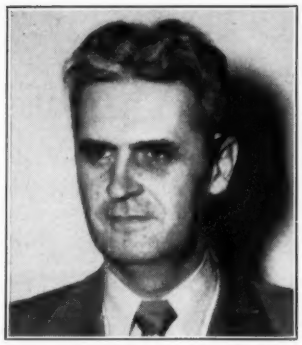
A large variety of colors can be obtained in depths ranging from pastels to deep, heavy shades. With care in the quantity of copper sulfate used in the dyeing, bright shades can be produced.

In general, the fastness to light, washing, perspiration, and crocking are quite similar to that of the corresponding dyes on wool. To obtain maximum fastness, these dyes must be applied at a good rolling boil.

Since no dyeing assistants such as p-phenylphenol are required, vigorous scouring after dyeing is unnecessary. Rinsing to remove excess surface dye is sufficient.

In general, the preferred method for applying acid and direct dyes by the "cuprous ion" method is to first treat the fiber with 1-3% copper sulfate, followed by 3-5% hydroxyl ammonium sulfate at the boil for 10 minutes. Dyeing is carried out at the boil for 30 minutes, then 4% sulfuric acid is added, and boiling is continued for an additional 30 minutes to one hour. The fiber is then rinsed well and dried. For maximum fastness the higher quantities of copper sulfate may be required, but for added brilliance of shades, the lower percentages are preferred.

BASIC DYES—The use of basic dyes to color X-51 acrylic staple shows some



A L Peiker

interesting possibilities. In general, the dyes exhibit the usual brilliance, fair-good wash fastness, good fastness to crocking, and in most cases exhibit fair-good light fastness. In the application of basic dyes no assistants or mordants are required. Care in dyeing must be exercised because of the rapid rate of dye exhaustion. This can be controlled by starting the dyeing at low temperatures. The goods are kept at room temperature for about twenty minutes, after which the temperature of the dye bath is raised gradually to about 160°F and the dyeing completed.

VAT DYES — X-51 staple is unique among the acrylic fibers now on the market in that it can be dyed a wide range of shades with vat dyes from an alkaline bath. In common with most of the other fibers, these dyes can be applied also by modifications of the vat-acid methods. These methods are, however, more difficult to control and good end results are somewhat uncertain.

The fastness to washing, perspiration, and crocking is excellent. If properly applied, the fastness to light is in the range expected, providing the depth of shade is taken into account. It should be pointed out at this time that there are some anomalies to be found among these dyes. The usual cotton and rayon shade cards and fastness charts should not be relied upon for accurate data as to performance on hydrophobic fibers.

When applying the vats in alkaline baths, the dyes may be applied by either the reduced vat dyeing procedure, or they may be pigmented onto the X-51 and then reduced in the presence of the goods.

In dyeing X-51 staple by either the reduced vat method or the pigmentation method the concentration of caustic soda and hydrosulfite should not exceed 1 oz per gal and 1¼ oz per gal, respectively. The dyeing should be started cold, and temperatures above 160°F should be avoided. Since prolonged exposure to caustic at high temperatures will cause some discoloration of X-51 staple, the oxidation of the vat dye should be carried out at room temperature with hydrogen peroxide and acetic acid. The finishing is carried out at the boil with acetic acid and Duponol WA.

SOLUBLE VAT DYES—Light to medium shades can be produced on X-51 acrylic staple by means of the soluble leuco ester vat dyes. In view of the ease with which X-51 staple can be dyed by the regular vat dyes, the use of the more expensive soluble vats may be somewhat restricted. In the case of certain blends of other fibers with X-51, the soluble vats may show some advantages. Each blend, however, is a study in itself.

FILAMENT

The dyeing properties of X-51 continuous filament acrylic fiber differ materially from the dyeing properties of X-51 staple. The principal difference is the depth of shades obtainable. The continuous filament can be dyed by the following classes of dyes: acetate, acid and direct, basic, vat, and soluble vat.

Before discussing the dyeing of X-51 acrylic filament, it must be pointed out that the statements that will be made are based on fewer dyeing experiments than was the case with the staple fiber. To date, less filament yarn has been available for study.

SCOURING—The most efficient scouring method that has been devised to date for X-51 continuous filament is to boil the fabric 15-30 minutes in a solution containing 0.25% Deceresol OT Wetting Agent and 0.1% glacial acetic acid.

ACETATE DYES—At the present state of knowledge, the acetate dyes show the most promise for dyeing continuous filament. The build-up in depth of shade, except at temperatures above the boil, is not quite so good as the build-up on the staple.

At the boil, light to medium shades can be produced. At temperatures of 240-250°F, heavy shades can be obtained.

In general, the fastness of these dyes on continuous filament is better than the fastness on X-51 staple and is about equal to the fastness on acetate filament. This statement holds true for fastness to light, washing, perspiration, and crocking. The fastness to gas fading appears to be better on X-51 than on acetate. Some dyes do, however, show color changes when subjected to the usual gas-fading test.

The depth of shade, per unit weight of dye in the dye-bath, and the fastness properties obtained at equal depth of shade are improved appreciably by an increase in dyeing temperatures.

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COPPER AS A TEXTILE FIBER PRESERVATIVE

H L von GOEHDE

Director of Research
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INTRODUCTION

IN THE last 15 years, primarily because of military stress, there has been an increasing interest in the impregnation of fibrous materials with copper compounds, much of the interest being reflected in the literature, but the idea of applying copper solutions to textile fibers is not particularly new.

The fungistatic value of copper was first discovered by Justus Liebig, who found, that by combining copper with lime and/or other alkaline derivatives, excellent fungicides and insecticides were created. Bodowski *(1)* referred to the work of Engler and Markonikov, who, from 1885-1894 made experiments with metallic naphthanates. Their combined efforts revealed that copper and zinc fused to naphthenic acids increased and prolonged the prevention of microbiological deterioration of wood. In these studies, copper was found to be more effective than zinc, cobalt or lead.

In 1937, Jarrell, Stuart, and Holman *(2)* found that mineral khaki dye could be made mildew-resistant by the addition of a relatively insoluable copper compound. According to their reports, they found three effective methods of mildew-proofing cotton duck. Minimal protection was effected by preciptating insoluble copper compounds by means of Na_2CO_3; by including copper compounds with other metal compounds in mineral dyes, and by adding basic $CuCO_3$ to a waterproofing mixture. In each instance effectual resistance was set up only when the copper contents of the solutions used were equal to at least 0.11 per cent of metallic copper based on the weight of the finished fabric. However, they found that for maximal effectual benefit, a copper compound had to be used that contained at least 1.7 per cent of metallic copper based on the weight of the finished fabrics. When chromium and iron were included in the formula, somewhat less copper was required.

By 1938, the use of copper naphthanate had become so widespread, especially in the treatment of wood, that Smith *(3)* responded to the need for general information regarding its origin. Copper naphthanate, he stated, is a combination of copper with the napthenic acids found in petroleum oil. It is soluble in kerosene, toluene, turpentine and similar organic solvents.

H L von Goehde

The author, a member of the National Research Council, reviews some of the outstanding literature of the past 15 years on the subject of impregnating fibrous materials with copper compounds.

He draws the conclusion that of all the radicals coupled to copper, 8-hydroxyquinoline seems to have the most effective fungistatic properties, lending itself best to the problems confronted. He also indicates that the greatest protection is given the fiber when it is impregnated with solution rather than coated.

Although the use of copper compounds gained steadily, it was recognized that some compounds were more effectual fungicides than others, and, indeed, that some compounds might be ineffectual because of the affinity of the copper ion to soil. In 1941, Armstrong *(4,5)* was concerned with the problem of mildew-proofing jute sandbags for military purposes. As a result of his studies, he recommended the use of 1) tar distillate or creosote (25 per cent in fiber); 2) copper compounds, such as naphthanate, oleate, or stearate (0.8 to 1.0 per cent of copper to be residual in the fiber); 3) cuprammonium solution (1.0 to 1.5 per cent of copper to be deposited in the fiber); 4) copper salts, such as copper chromate, aqueous colloid copper and copper carbonate; or 5) cutch-cuprammonium solutions requiring a two-bath process (0.8 to 1.0 per cent of copper to be deposited in the fiber). He found that a minimum of 0.35 per cent of copper must be residual in the fibers to prevent microbiological deterioration.

In 1942, Jamison promoted his theory that copper was easily absorbed by soils. Consequently, if the copper ion were the only fungicidal element of a particular compound, its absorption into soil might leave treated fabrics completely unprotected after contact with earth. However, by coupling copper to a radical, such as the naphthanate (or 8-hydroxyquinoline) which had been demonstrated to possess fungicidal capacity (Marsh *(7))*, the loss of copper by absorption would still leave the treated material protected to the extent that the radical was individually fungicidal. Osnitskaya *(8)*, however, in the same year, differed with this concept. She claimed that naphthenic acids might possibly serve as a source of carbon for some species of micro-organisms.

War in the South Pacific area intensified research in and sharply increased the number of publications in the field of fibrous textile presentation as it became obvious that the climate in that area required particular attention to the most effectual preservative means. Woodford *(9)*, investigating the effect of the Indian climate on military textiles of cellulose origin, decided the copper in some form was a definite requirement for fungicidal protection. To increase the effectiveness of copper, he proposed the use of such binders as plasticized pitch, gear oil, and bitumious emulsion.

Azevado and Maffei *(10)* reported the results of their investigations in treating cotton canvas. Their most effective method consisted of immersing the canvas in a 10 per cent solution of copper sulfate, followed by immersion in a 10 per cent sodium hydroxide solution.

CONCLUSIONS

The references cited, to which many could undoubtedly be added, furnish only a framework of the results of the investigations into methods of treating textiles with fungistatic compounds. The intimate study of these references indicates that copper within a minimum-maximum range of 0.35 per cent to 10 per

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Vice-Chairman—J C WHITT *Treasurer*—HERMAN J JORDAN, JR

SOUTHEASTERN

Chairman.....S JACK DAVIS, Callaway Mills Co, La Grange, Ga
Secretary....JAMES W SWINEY, Fulton Bag & Cotton Mills, Atlanta, Ga
Vice-Chairman—T HOWARD McCAMY *Treasurer*—WILLIAM B AMOS

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Secretary.....R WILBURN FREEZE, American Aniline Products, Inc, 4001 Rossville Blvd, Chattanooga, Tenn
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Student Chapters

BRADFORD DURFEE TECHNICAL INSTITUTE, CLEMSON COLLEGE, GEORGIA INSTITUTE OF TECHNOLOGY, LOWELL TEXTILE INSTITUTE, NEW BEDFORD TEXTILE INSTITUTE, NORTH CAROLINA STATE COLLEGE, PHILADELPHIA TEXTILE INSTITUTE, UTICA TECHNICAL INSTITUTE, FAIRLEIGH DICKINSON COLLEGE

AATCC CALENDAR

COUNCIL: April 18 and June 13 (New York); Sept 19 (Philadelphia); Nov 6 (Boston).

GENERAL RESEARCH COMMITTEE: Dates and sites are the same as the Council's.

NATIONAL CONVENTIONS: 1952—November 6-8, Boston, Mass: 1953—Sept 17-19, Hotel Conrad Hilton, Chicago, Ill; 1954—Atlanta, Ga.

HUDSON-MOHAWK SECTION: Mar 21, May 2 (Jack's Restaurant, Albany, N Y); June 20 (Annual Outing).

MID-WEST SECTION: April 19 (Hotel Netherlands Plaza, Cincinnati, O); June 14 (Lake Lawn Lodge, Delavan, Wisc); October 4 (Hotel Bismarck, Chicago, Ill).

NEW YORK SECTION: March 21 (Fairleigh-Dickinson College, Rutherford, N J); April 18 (Swiss Chalet); May 16 (Swiss Chalet); June 20 (Outing).

NORTHERN NEW ENGLAND SECTION: April 18 (LTI); May 16 (Andover Country Club); June 6 (Annual Outing, Merrimack Valley Country Club); Dec 6 (1952 Annual Meeting, LTI).

PACIFIC SOUTHWEST SECTION: March 28, 1952.

PHILADELPHIA SECTION: April 25 (Abraham Lincoln Hotel, Reading, Pa); June 13 (Outing, Lu Lu Temple Country Club, North Hills, Pa).

PIEDMONT SECTION: April 26 (Clemson Hotel, Clemson, S C); June 6-7 (Ocean Forest Hotel, Myrtle Beach, S C); Sept. 13 (Hotel Charlotte, Charlotte, N C).

RHODE ISLAND SECTION: Mar 28 (Providence Engineering Society); April 25 (Wannamoisett Country Club); May 23 (Providence Engineering Society); June 6 (Annual Outing—Wannamoisett Country Club); Oct 24 (Providence Engineering Society); Dec 5 (Annual Meeting, Sheraton-Biltmore, Providence).

SOUTH CENTRAL SECTION: May 17 (Patten Hotel, Chattanooga, Tenn); Aug 22-23 (Summer Outing, Chattanooga Golf and Country Club); Dec 6 (Patten Hotel).

WESTERN NEW ENGLAND SECTION: May 2 (Ladies Night, Cheshire, Conn); June 20 (Outing); Oct 3, Nov 14 and Dec 12 (Rapp's).

OTHER EVENTS

ACHEMA X

Exhibition Meeting for Chemical Engineering, May 18-25, Frankfort/M, Germany.

AMERICAN CHEMICAL SOCIETY

7th National Chemical Exposition, Sept 9-13, Chicago Coliseum, Chicago, Ill. This will include the 2nd International Art Exhibit.

AMERICAN OIL CHEMISTS SOCIETY

Forty-third Annual Meeting, April 28-30, Shamrock Hotel, Houston, Texas

Short Course industrial trips, July 8-9, 10-11.

AMERICAN SOCIETY FOR QUALITY CONTROL

Sixth Annual Convention, May 22-24, Syracuse, New York.

AMERICAN SOCIETY FOR TESTING MATERIALS

Annual Meeting, June 23-27, 1952, New York, N Y. (The biennial Apparatus and Photographic Exhibits will be held in conjunction with this meeting).

1953—Spring Meeting (Hotel Statler, Detroit, Mich.)

Annual Meeting (Chalfonte-Haddon Hall, Atlantic City, N J.)

1954—Spring Meeting (Shoreham Hotel, Washington, D C)

Annual Meeting (Sherman Hotel, Chicago, Ill.)

AMERICAN STANDARDS ASSOCIATION

3rd National Standardization Conference, Sept 8-10, Museum of Science and Industry, Chicago, Ill.

34th Annual Meeting, November 19, Waldorf-Astoria, New York, N Y.

BRITISH INDUSTRIES FAIR

May 5-16, London and Birmingham, England.

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS

Annual Meeting (Quebec Section) April 25-26, Mount Royal Hotel, Montreal, Que.

CANADIAN TEXTILE SEMINAR

September 11-13, Queen's University, Kingston, Ont.

CHICAGO INTERNATIONAL TRADE FAIR

Mar 22-April 6, Navy Pier, Chicago, Ill.

FIBER SOCIETY

Meeting: April 16-17, 1952 (Clemson House, Clemson, S C); Sept 10-11 (Princeton, N J).

LEIPZIG FAIR

September 7-17, Leipzig, Germany.

NATIONAL ASSOCIATION OF HOSIERY MANUFACTURERS

41st Knitting Arts Exhibition, April 27-May 1, 1953, Atlantic City Auditorium, Atlantic City, N J.

NATIONAL KNITTED OUTERWEAR ASSOCIATION and UNDERWEAR INSTITUTE

Knitting and Allied Crafts Exposition, April 21-25, Grand Central Palace, New York, N Y.

AMERICAN TEXTILE MACHINERY ASSOCIATION

Exhibit of American Textile Machinery, April 26-May 1, 1954, Atlantic City Exhibition Hall, Atlantic City, N J.

NEW YORK BOARD OF TRADE

26th Annual Meeting: September 25-28, Pocono Manor Inn, Pocono Manor, Pa.

NORTH CAROLINA STATE COLLEGE

Textile Open House, April 5, School of Textiles, Raleigh, N C.

PHI PSI FRATERNITY

49th Annual Convention, May 1-3, Clemson House, Clemson, S C.

PURDUE INDUSTRIAL WASTE CONFERENCE

May 7-9, Purdue Memorial Union, Purdue University, Lafayette, Indiana.

SOCIETE DE CHEMIE INDUSTRIELLE

25th International Congress for Industrial Chemistry, May 18-25, Paris, France.

THE WOOL BUREAU, INC

International Wool Research Project Seminar, April 7-9, Lowell Textile Institute, Lowell, Mass.

TEXTILE INSTITUTE

Annual Conference, June 2-6, Edinburgh, Scotland.

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

52-8

Education: textile evening, plus university courses in factory management and quality control.

Experience: Superintendent, woolen and worsted cloth manufacturing.

Age: 37; married; references; north Atlantic coast preferred. 3-3, 3-17

52-9

Education: B T C, Lowell Textile Institute.

Experience: Textile chemist, worsted and woolen mills.

Age: 58; married; references; New England preferred. 3-3, 3-17

52-10

Education: Chemistry & dyeing, Philadelphia Textile Institute, night school.

Experience: Dyehouse foreman, yarns of all fibers.

Age: 40; married; veteran. 3-17, 3-31

52-11

Education: BS, Textile Engineering, Lowell Textile Institute.

Experience: Mill liaison with selling office.

Age: 24; single; position as textile engineer in production or sales co-ordination desired; location immaterial. 3-17, 3-31

Intersectional Contest———

TOWARD A SIMPLE MEANS OF JUDGING HAND*

SOUTH CENTRAL SECTION

COMMITTEE
D H Gunther, *Chairman and Speaker*
R D Blum, Jr
G W Hakanson
A J Kelly
W F Luther

INTRODUCTION

IN PRESENTING a paper of this nature we are acutely aware of the hazards involved, and we have a sharp sense of moving in on ground where angels fear to tread. For, in spite of the vast amount of work already done and some monumental reports on the subject, the fact remains that the ancient and honorable means of judging hand by the manual or manipulative method is still in almost universal mill use today. Standard methods or procedure have, to a greater or less extent, found acceptance for evaluating detergency, wetting, wear resistance, flameproofing, etc; but so far the evaluation of hand is still largely an art, most efficiently performed through the skilled senses of an experienced finisher. A survey of a number of finishing plants confirmed the truth of this. There are many good and obvious reasons why this is so and likely to remain so. But this has not deterred investigation in the past and will not in the future—nor has it deterred us now. Our aim is expressed by the title; we hope this may be a useful contribution toward the ultimate end in view. No substitute for the knowing touch of the hand of the capable finisher is offered. But that this same experienced and capable finisher needs and welcomes any assistance that can be offered cannot be doubted. A mechanical aid, whether or not of ultimate value, will save the skill of the craftsman for the final decisions and relieve him of fatiguing mental and physical effort. Such a mechanical aid is offered here.

There is no question of the effort involved in the careful evaluation of hand; and this effort may become more intense if a great deal is at stake in such an evaluation or decision. One of the members of this committee proposed as a subtitle, "Anguished Thoughts of a Harried Finisher With a Bundle of Swatches in Hand". Another who was more constructive has listed the conditions which he considers essential for the proper carrying out of the delicate operation of judging the hand of a fabric. First, complete relaxation is indispensable since complete concentration is required to judge fairly the delicate shadings of feel in a series of swatches, some of which may differ in only minute degree. The hands should be washed thoroughly to remove oil and grease, then a small amount of lotion worked in. The hands are then thoroughly dried, and the finger tips are rubbed lightly with very fine sandpaper to remove any rough skin and to leave the fingers extra sensitive. The swatches should all be of the same dimensions, for size variations are known to affect the feel or at least the mental interpretation of feel. Identification should be such that it is not apparent during judging. Telephone calls or other interruptions must be banned, otherwise the whole effort may often have to be started all over again. Evaluation must be done with the same hand, or, if both hands are used, they must be used for all swatches in the same manner; often the same sample feels softer or more harsh in the opposite hand. Finally, and this was included in all seriousness, the mood or state of mind must be properly disposed toward the work at hand. With these conditions it is often possible to grade a series of swatches with a high degree of confidence in the fairness and accuracy of the test. Where only limited samples are available, it is essential that the whole series be considered simultaneously since the same swatches cannot be safely reused because of the effect on the hand of the manipulation involved in evaluating hand. All this sounds involved, but yet it must be agreed that it is not too far-fetched. Although all of these conditions would seldom be met, and would be impossible for the busy supervisor of a large finishing plant or dyehouse, yet no one would deny their desirability in making an honest appraisal. The need of a mechanical aid, if possible, is apparent. One major deterrent toward a standard method of evaluating hand is the number of factors involved in the simple term "hand". Besides meaning all things to all people it also means very definite and specific things to many people. Under the heading of hand might fairly be included softness, fullness, stiffness, limpness, flexibility, rigidity, crush resistance, harshness, boardiness and a number of other properties, which might conceivably be judged by the simple manipulation of a fabric.

As we have said, a great deal of fine work has been done in this field, and it is therefore rather surprising to find that, insofar as the practical commercial production of textile fabrics is concerned, the manual or manipulative method is almost universally used. As one large finisher said, "Our customers evaluate softness by hand . . . any other method would be valueless to us". This remark is not so much a statement of

D H Gunther

As the title suggests, this is a study to find a mechanical means of judging the hand of very soft fabrics. A survey of several mills indicated that the manual method was almost universally employed because present mechanical means did not show up small differences in hand of very soft fabrics. Although there probably never will be a substitute for the knowing touch of the experienced finisher, a mechanical aid would facilitate his work. Several devices, many of them novel, were constructed and evaluated. One method in particular, described as the "ring method", has considerable promise and briefly consists of pulling a specific swatch through a poteye of certain specifications and at the same time of measuring the maximum tension required. In an attempt to test yarns as well as fabrics, an apparatus was developed that compares the bending modulus of yarns, the device, which is described in detail, should be a real contribution to the field of testing yarns.

* Presented at the 30th Annual Convention in New York, N Y on October 19, 1951.

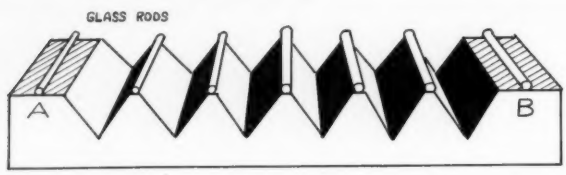

Figure 1
Saw-tooth Apparatus

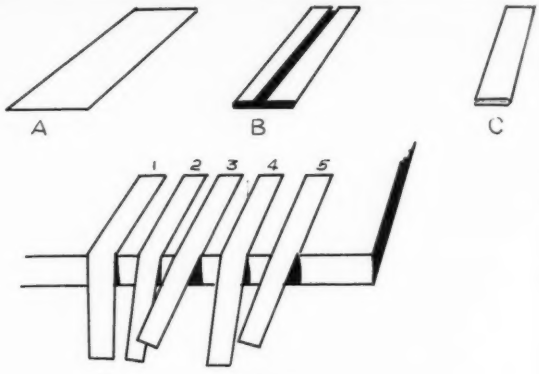

Figure 2
Folded-Fabric Test

fact per se, but a statement of a condition that exists. A simple comparative method of judging hand would be most useful to this and to any finisher. Another mill made an evaluation of 3 methods of determining hand by the use of the Planoflex, the Friction Meter, and the Compression Meter and concluded that measurements obtained from these machines did not correlate very well with small differences in hand; it was impossible to correlate the results of one machine to those of another for a fabric series of similar construction with a single variable such as filling content. Consideration of the results of an individual machine indicated no uniform tendency of the fabric toward the designated hand. The general consensus seems to be that measurements made with the available or proposed devices do not correlate too well with manual methods, and that small differences in hand are difficult to detect.

Of the many references in the literature, we particularly cite articles by Peirce (*1*), "The Handle of Cloth as a Measurable Quantity", and by Skinkle (*2*), "Handle or Draping Quality", to give the reader a broad picture of what has been said and done in this field. It is not our intent to describe the many devices proposed by them and by others, but merely to point to their existance, and to discuss them only as they may be related to our work. Acknowledgment is made both because it is a part of the continuing effort toward a common goal, and because of our indebtedness to these workers. Although we believe the procedures we have followed and the experiments we have made have not been previously done, we realize that all of us inevitably, whether consciously or no, borrow from the work of others and, further, are influenced thereby.

Our study has been entirely with soft fabrics and might not be applicable either in whole or in part to heavier fabrics. Generally, however, the fine judgment of hand would be more important and at the same time more difficult for such fabrics. Our work might be said to consist of the conception and testing of several simple apparati for mechanical evaluation of hand. Although none represents a final answer to the problem, we believe one in particular has quite useful features, and that possibly others might serve as spring boards of thought for further fruitful effort.

EXPERIMENTAL

PIECE GOODS——Of the devices finally considered, the first was as shown in Figure 1. An apparatus was constructed of wood having a saw-tooth appearance. At the edge of each tooth a smooth glass rod was cemented to lessen friction and to provide a uniform surface. Strips 1¼" x 28¾" were then cut from fabrics of identical construction but varying softness, marked at A and B, and then laid on the apparatus. It was reasonably expected that the softened fabric would drop or sag into the V-cuts, and the amount of such sag could be easily measured by the decrease in over-all length of the fabric strip. Unfortunately, little consistent difference could be detected, and then not in a consistent direction. This contrivance was reluctantly dropped, although this saw-tooth device, in the proper size, may have value for studying other fabrics, and it is our hope to consider this further at a later time. Although innumerable swatches were studied and many different widths and constructions considered, no consistent results with soft fabrics appeared possible. A last suggestion was made to substitute rollers (glass or plastic) for the cemented rods at the top of each tooth, but time did not permit construction of such a modification. The appeal of simplicity and of directness in reading is such that we hope and believe a useful machine may eventually be made on this principle.

Another experiment was a procedure rather than a method, although it is based on the bending or flexing of a strip of fabric gradually pushed forward and allowed to fall off a square edge. It was found that a better measure of softness was obtained when the fabrics were folded as indicated in Figure 2. Several samples of cloth were cut 8" wide, folded twice, placed in a parallel position on a glass-covered table and uniformly pushed over the edge by the aid of a metal rod. The results were encouraging as there appeared to be a definite order of bending. For this particular test very soft fabric was used, which had been tested with several different softening agents. This procedure is not entirely mechanical since the operator is required to observe intently to determine the rapid order of bending. As a modification, pieces were cut 1" by 2", single thickness, and stapled ⅜" from the edge of a stiff cardboard (Fig 3). With the cardboard in a horizontal position, the fabrics bent in a definite pattern, duplicating rather closely the order found by manual testing. Although simple, this method was quick and had the added advantage of allowing many samples to be evaluated simultaneously.

Serious consideration was given to the inclined plane apparatus reported by Peterson, Dantzig, Skinkle and Peirce.

Cotton sheeting was processed to obtain varying degrees of softness from harsh (Sample 1) to very soft (Sample 5). An instrument was constructed to duplicate that of J H Skinkle, based on an inclined plane (Fig 4). When results with an angle of 45° did not appear reasonable for very soft fabric, a modification of the instrument was added, a movable angle similar to the method of F T Peirce (*1*). Cloth was tested at 34°, 45°, 55°, 60°, 62½°, 74° and 90°. Actually, at an angle of 62½° results were more consistent than at 45°. Note that the curve for 62½° is more in accord with the actual hand than for 45° (Fig 5). Perfect results would have been indicated by a straight diagonal line. This apparatus might be improved by use of a movable angle at A. Skinkle suggests an angle of 45° be used and the length of fabric measured where the strip of fabric touches the inclined plane. Peirce uses a known length of fabric and measures the angle that the cloth bends. In this instance, we used various angles for each series and measured the length of cloth where it touched the inclined plane.

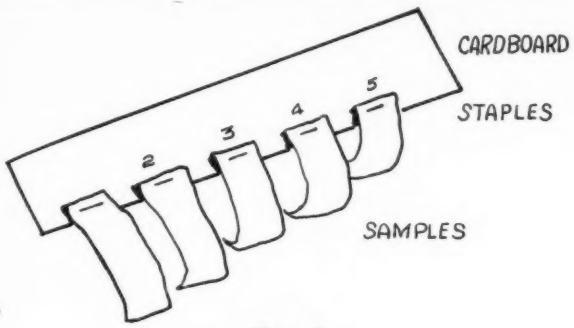

Figure 3
Rapid Bending Test

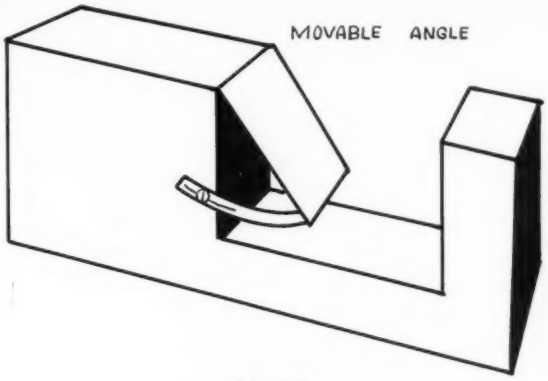

Figure 4
Inclined-Plane Apparatus

There probably is an optimum angle at which the particular fabric used, in this case, cotton sheeting, works best. The results at 62½° duplicated manual evaluation fairly well, although the method requires a certain amount of skill.

The Heart Loop method was also investigated because it has great appeal, being easy to apply and requiring no particular apparatus or setup. However for the soft fabrics being tested, no consistent results were obtained.

HAND OF YARN —— Although this committee has been primarily concerned with evaluating the hand of fabrics, especially soft fabrics, a report of certain work done on the testing of single strands of yarn is in order, particularly in view of the fact that a simple effective device for the determination of certain properties of yarns has resulted from this work.

In describing the physical properties of yarns, the hand characteristic is seldom mentioned in the way that it is for fabrics. Often related terms like "harsh yarn", "soft yarn", and "rough yarn" are used, but usually they are not thought of as describing the hand of the yarn. However, yarn can be felt before it is converted into fabric, and the conception and consideration of hand in connection with yarn as such is thought to be useful by this committee.

It is of course self-evident that those physical properties affecting the feel or hand of yarn will also affect the hand of the fabric made from it. Thus a stiff yarn when knitted or woven will produce a stiffer fabric than one made in the same way from a soft yarn. Likewise, a smooth yarn will produce a smoother fabric than a rough yarn used in the same way.

Therefore measurements defining the stiffness or limpness and roughness or smoothness of a yarn should be very helpful in predicting similar properties of hand in fabric. Further, such yarn measurements are useful in controling the efficiency of performance of the yarn during knitting or weaving operations.

It is in this latter category that considerable work has been done to measure the smoothness, lubricity and drag of yarns as a control for their knitting and weaving performance. This is ordinarily done by means of drawing the yarn through or around a suitable tensioning device and noting the tension as measured by a suitable yarn tension meter.

Very little work has been reported, however, concerning apparatus or methods for the measurement of the stiffness of yarns outside of that by Saxl (3).

A simple instrument, easy and quick to operate, for the measurement of stiffness in yarns would be a very worthy asset to certain textile personnel, for example fabric designers, to better select the proper yarn to obtain the desired degree of stiffness or softness in a certain fabric. Such an instrument would also be a valuable laboratory tool to the textile chemist who is seeking to measure the comparative softening or sizing effects obtained with certain textile chemicals applied to yarns.

After considering those dynamic properties of yarn which are a direct function of stiffness, we decided that bending modulus would be the one most easily measured as well as most meaningful. Now, the bending modulus of yarns can be very easily compared by supporting a given length of yarn at one end and observing the amount of

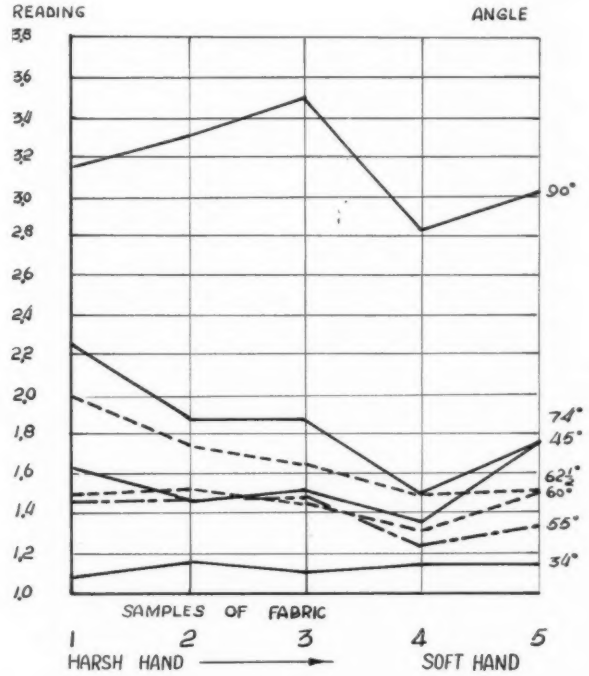

Figure 5
Inclined Plane Method With Various Angles

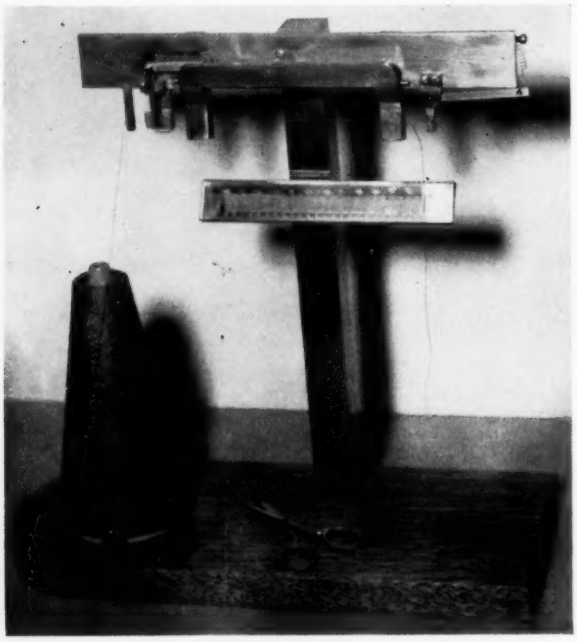

Figure 6
Flexometer: Strand of Yarn Mounted Ready for Test

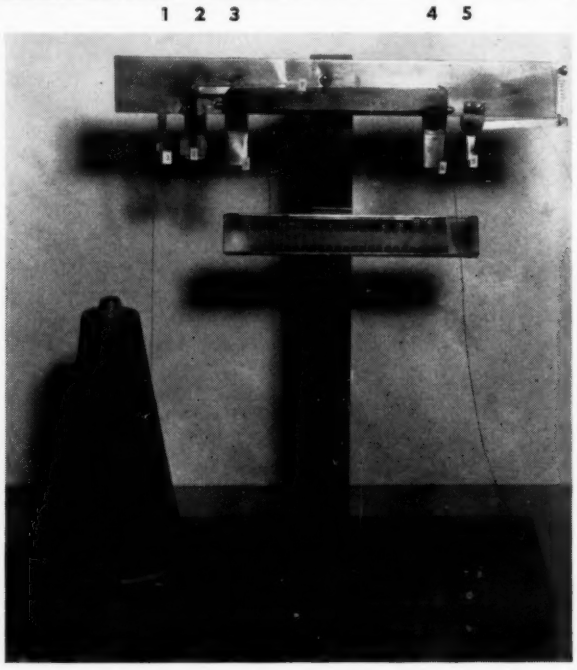

Figure 7
Flexometer: Strand of Yarn Showing a Deflection of 1.4 units from the Vertical

deflection from the horizontal. A very suitable modification of this principle is embodied in the instrument that has been developed by W F Luther of this committee and is amply illustrated in Figures 6 and 7. Figure 6 shows a strand of yarn mounted in the instrument ready for the test. Figure 7 shows the strand after it has been cut and a deflection of 1.4 units from the vertical has been obtained.

In brief the test is made by threading the yarn from the cone or supply package through the small porcelain eyelet No 1 (extreme left), by leading the yarn through the jaws No 2, No 3 and No 4 with the right hand while the jaws are opened by pressing with the left hand against the spring tension above No 3. After being threaded up, the yarn is pulled around post No 5 until enough tension is applied just to move the bar holding the small end coil spring, while jaws No 3 and No 4 are held open by pressing lightly with the left thumb at point No 3. This assures a constant tension and length of yarn between jaws No 3 and No 4. The scissors are then used to snip the yarn flush with the inside of jaw No 4, whereby the yarn falls down and across the centimeter glass scale backed with a mirror to avoid any error from parallax.

A distance of 4 inches was used between jaws 3 and 4 as this length of yarn was found adequate for all yarns of varying size and stiffness. In Table I are listed a few of the different types of yarn tested and their readings on the Flexometer centimeter scale.

This instrument was used to determine the effect of softening agents upon yarn flexibility. Skeins of 30/2 mercerized yarn were treated with a solution of a well-known anionic-type softener containing from 0 to 15% of softener on weight of yarn. The results of the Flexometer readings indicated that the softest or most flexible yarn was obtained with approximately 2% softener. This confirmed previous findings or experience that knitting yarns treated with more than 2% softener felt loaded, or stiff, and did not knit very well.

It is the opinion of this committee that the results from this yarn flexibility meter together with lubricity measurements as made with a yarn tensometer are very useful for the evaluation and comparison of yarn softeners and other finishing agents.

The flexibility measurements can be made very quickly and accurately. It has generally been found that a technician can determine the average of five readings on a given sample in less than three minutes.

It is the hope of this committee that the simple comparative yarn flexometer developed in connection with this work will be found useful as a control instrument, not only for the uses outlined in this paper but for other uses as well.

TABLE I

Yarn	Description	Average Reading cm
29/2	Unmercerized cotton	1.6
30/2	Mercerized cotton	2.1
50/2	Mercerized cotton	1.5
29/2	Unmercerized cotton, sized	4.2
30/2	Spun nylon	1.2
60/2	Spun nylon	0.7
34-denier, 16 filament nylon (unsized)		3.5
34-denier, 16 filament nylon (sized)		7.0
30/2	Spun Dynel	1.0

ANOTHER FABRIC TESTER —— Another experiment, originating from a member's suggestion, was based on the fact that a soft fabric should tend to drape or sag through a circular opening; the greater the degree of softening, the more the fabric should drape or sag. Therefore an apparatus was assembled as illustrated in Figure 8. Bleached tubular knit cotton fabric was treated with various softening agents, and circles of the fabric were cut slightly larger in diameter than a large glass funnel. This funnel had a rounded, smooth lip and a long graduated stem. The circle of fabric was placed over the lip of the funnel, and then a fine thread was hooked to the center of the circle of fabric to allow the thread to drop down through the stem. It was reasoned that, if a fabric was stiff, there would be little or no sag and this fact would be indicated by the knotted thread against the graduated stem at zero. If the fabric was very soft, the knot in the thread would be lower in the stem and the result could be recorded. Since the lip was smooth there would be little friction against the fabric.

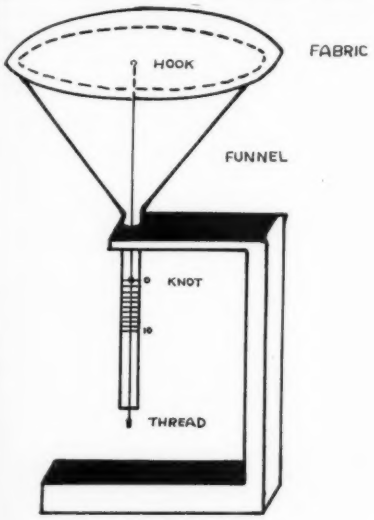

Figure 8
Funnel Apparatus

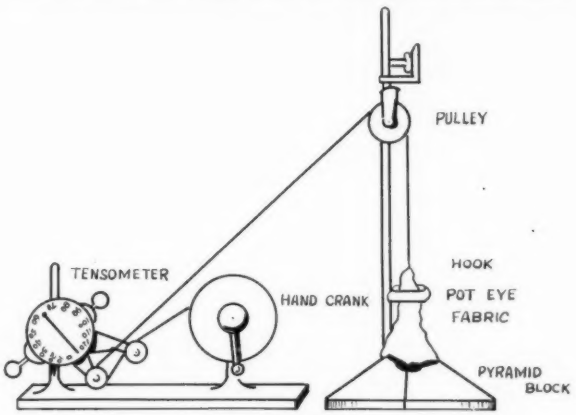

Figure 9
Apparatus for Ring Method

After several tests, however, we discarded this setup as the small area of fabric did not drape enough. Possibly a larger glass or porcelain funnel would prove more successful as the weight per unit area of fabric is probably an important factor in drape.

HAND OF FABRICS BY RING METHOD——Of the work done with fabrics by this committee, the greatest value lies in that reported below, and so a few preliminary remarks may be justified. In observing the means of judging hand used by many experienced and capable finishers, it was particularly noted that a crushing motion or variation thereof nearly always appeared to be most important in the finger manipulations used. One man characteristically grasped a section of cloth at the selvages and gently pushed them together. Another would gently press or squeeze a number of folds or bolt of the cloth to reach a conclusion. On knit fabrics still another operator would wrap his hand around the material and slowly pass his hand up and down obtaining a simultaneous compressing and sliding effect. Many use as part of their routine the simple procedure of crushing a ball of the goods in the hand and evaluating the result by tactile and visual means. It was therefore felt that a mechanical means of judging hand might have increased chance of success (that is, of correlating with tactile evaluation) if it embraced in whole or in part some sort of compressive test. In Figure 9 is illustrated a simple device which achieves this end. A piece of cloth is pulled through a porcelain pot eye, and the amount of pressure required is recorded on a tensometer. On initial trials the fabric was cut in a circle with an 8″ diameter and pulled through a porcelain pot eye with the aid of a motor and variable transformer. The variac was set at 75 so that the pull would be constant. Bleached cotton tubular knit fabric was used, samples being treated with increasing amounts of a single softener.

Although the results were generally encouraging, the method was not considered entirely practical, so it was decided to use a hand crank and a pyramid-shaped polished wooden block to cause each sample of cloth to drape itself in the same manner before it entered the pot eye. Nylon jersey knit

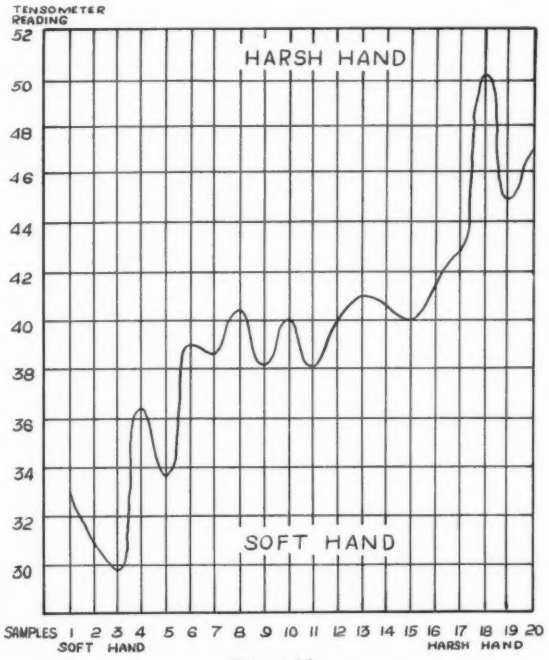

Figure 10
Graph Illustrating Ring Method vs Manual Testing of Hand

TABLE II
RESULTS BY RING METHOD

Order of Actual Hand By Manual Method Swatch No	Ring Method Tensometer Readings (Avg of 5 Tests)	Ring Method Instrumental Order of Hand Swatch No
1 softest	33.0	3 softest
2	31.0	2
3	29.7	1
4	36.5	5
5	33.7	4
6	39.0	11
7	38.7	9
8	40.5	7
9	38.1	6
10	40.0	10
11	38.0	15
12	40.0	12
13	41.0	8
14	40.6	14
15	40.0	13
16	41.6	16
17	42.7	17
18	50.2	19
19	43.0	20
20 stiffest	47.0	18 stiffest

goods were used for the second trial, and the samples were cut in a 9" by 9" square. This method proved more successful and the results closely duplicated the order obtained by hand evaluation (Table II and Figure 10). The porcelain pot eye (American Lava Corporation, No GE - 10565) had an inside diameter of 13/16 inches. The tensometer used was manufactured by the Sipp-Eastwood Corporation. Although the machine as originally built employed a motor, experience showed that slow cranking by hand was better. The key to the device is of course the accuracy of the tension device used, plus the relative freedom from friction of the pulleys, or at least their uniform and unvarying friction. This method showed a great deal of promise since it is a combined measure of drape, flexibility and lubricity. The maximum reading was taken in each case and an average of five readings made. A maximum-reading tensometer would facilitate readings.

Table II shows the result of an extensive series of tests by the ring method in comparison with manual evaluation. The manual evaluations represented the best judgment of a small group of experienced cloth handlers, while the ratings on the machine were made by a laboratory worker totally unversed in the art. Although agreement is not exact, it is in general close—definitely closer than the agreement found with any other mechanical means. Figure 10 graphically shows the relationship. We realize, of course, that until further proof is undertaken our findings are valid only for the particular fabric tested and for the particular variations in hand or softness present. Yet it would seem that, for piece goods, the ring method offers the closest approach to the tactile method for evaluating hand, which is a complex resultant of the factors of softness, flexibility and lubricity.

CONCLUSION

The evaluation of hand by any mechanical device will probably never fully satisfy the judgments of all skilled finishers arrived at from tactile manipulation. Further, because both psychological factors are involved in the judgments of hand, an instrumental evaluation will likely not fully satisfy the cloth manufacturer, the converter, and the seller of finished goods; each simply has a different set of values and a different emotional slant. Within reason, however, some of the factors that go to make up hand can be mechanically evaluated and compared; and it has been the purpose of this paper to present one such device for fabric samples and another for yarns. It is hoped that this may be another step along the way "toward a simple mechanical means of judging hand".

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1952 NATIONAL CONVENTION

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NOVEMBER 6, 7, 8, 1952

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America Advances Through Creative Chemistry

Intersectional Contest——

A STUDY OF THE EFFECTS OF FABRIC CONSTRUCTION AND MERCERIZATION ON THE LIGHT AND WASH FASTNESS OF VAT DYES*

SOUTHEASTERN SECTION

COMMITTEE

James H Stradley, *Chairman*
James L Taylor, *Speaker*
Lawrence A Burroughs
Frederick T Lense
Cecil B Ray

James L Taylor

An investigation of the possible effects of fabric construction and preparation on the light and wash fastness of vat-dyed fabrics has been conducted. Commercial fabrics of the same fiber composition, varying in fabric weight and construction, were used and were dyed with selected vat dyes that could be expected to show from poor to very good fastness to light and/or washing. The dyeings were conducted according to standard commercial procedures with and without mercerizing. The fastness characteristics were determined by standard procedures supplemented by microscopic studies. Although it is probably not possible to generalize from the few cases reported, the following results have been noted for the samples studied and the dyeing procedures employed:

1) The construction of a fabric is markedly influential in the penetration and depth of shade in a standard dyeing procedure.

2) Mercerization improves penetration and depth of shade for a given fabric in a standard dyeing procedure,

3) Lightfastness is a characteristic of the dyestuff itself and is apparently unaffected by fabric construction or previous mercerization,

4) Washfastness is a characteristic of the dyestuff itself and is apparently unaffected by fabric construction or previous mercerization.

INTRODUCTION

MANY references may be found in the current literature concerning the effect of factors, such as fiber structure and resin treatments, on the chemical characteristics of a dyed fabric. However, very little material can be found concerning the effect of cloth construction on the light and wash fastness of a dyed fabric.

Dyeing is a very important operation in a highly competitive industry. The dyer is continually pressed to match the rapid progress being made in the development of new fibers, new blends, and new uses for fabrics. To him it is becoming more and more essential to be able to produce faster colors more cheaply. If, therefore, variations in fabric construction affect even to a slight degree the results he is endeavoring to achieve, it behooves him to investigate them. Differences which today are considered insignificant may by tomorrow become a sizeable distinction, measurable in dollars and cents.

It is the purpose of this paper to determine how the factor of fabric construction affects the color fastness of vat-dyed cloth.

In an earlier investigation (*1*), which was a preliminary study undertaken by this Section co-operatively with Georgia Institute of Technology, a study was made to evaluate the effect of fabric construction on the color fastness of vat dyes applied to cotton fabrics. Plain, twill, and sateen fabrics were woven from the same lot of cotton yarn, the only variable being the type of weave and the number of picks per inch in the fabric. These fabrics were given the same bleaching treatment; however, a portion of the cloth was half-mercerized, another given a full mercerization treatment and another left unmercerized.

The vat dyes used in this study were Vat Khaki 2G, double paste (C I Pr 122), and Vat Brown G (C I Pr 121), double paste. These dyestuffs were chosen because of their wide use for military purposes and/or civilian work clothes.

The results of this study were not conclusive because of the light weight of the fabrics and the excessive openness of some of the fabrics. Another factor which contributed to indefinite results was the choice of dyestuffs; both dyes gave good lightfastness ratings and did not give sufficient contrast in the tests, thus making it difficult to distinguish slight changes which might possibly be caused by fabric construction.

Therefore, in a further effort to get conclusive data, a second study was instigated by the Southeastern Section in which commercial fabrics from the same mill and from the same cotton mix were used. These fabrics were selected so as to have a wide variation in construction. Dyes were also selected that could be expected to show from poor to very good fastness to light and/or washing. The colors chosen were Vat Yellow GC paste (C I Pr 9); Ponsol Yellow 5GLL (DuP); Vat Blue BCS (C I 1113); and Indigo MLB (C I 1184).

EXPERIMENTAL

FABRIC DESCRIPTION——The physical characteristics of the fabrics used for these tests are listed in Table I. These fabrics were made from the same cotton mix in order to eliminate all variables due to fiber composition.

It should be emphasized that in selecting these fabrics for study a wide range in weight per square yard was chosen (4.60 oz, 8.73 oz, and 12.54 oz) from common commercial types of fabrics, which also have a wide difference in fabric construction. At least 100 yards of each type of fabric was prepared for dyeing.

All fabric analyses were made in accordance with standard ASTM procedures.

PREPARATION FOR DYEING——All of the goods were singed with a natural gas flame and desized in the usual-type quench box with 0.5% bacterial enzyme and 0.08% wetting agent. The goods were dropped into a box and allowed to stand for three hours and then were washed to remove the dissolved starch. One half of each construction was then mercerized in the wet

* Presented at the 30th National Convention in New York, N Y on October 19, 1951.

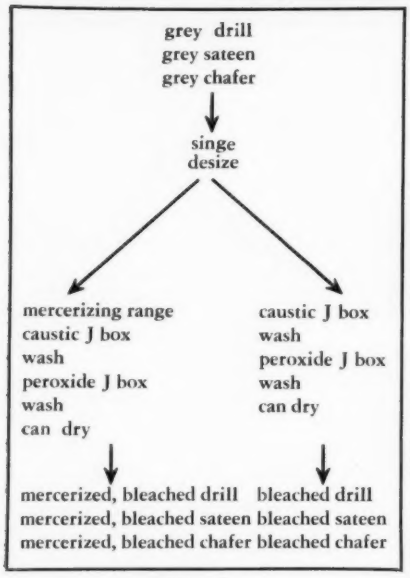


Figure 1
Flow Chart for Fabric Preparation

state through 54° Tw caustic soda, then passed into a 90′ tenter frame equipped with a four-unit Scott Suction System, and then into three Williams Units.

The first Williams Unit was a fresh-water wash, which was dumped. Fresh water entered the second Williams Unit and counter-flowed through the third Williams Unit and through all the Scott Suction Units.

Both the mercerized and unmercerized portions were then boiled and bleached in a DuPont Continuous Open-Width Bleaching Range with two Williams Units of hot wash after the boil and after the bleach. Four % caustic soda was applied in the saturator of the caustic section of the range and 52 lb of 35% hydrogen peroxide and 54 lb of 42° Bé sodium silicate per 100 gallons was applied in a saturator of the peroxide section. The cloth temperature in each J box was 205-210° F with a retention time of one hour in each box. The goods were then dried and sent to the laboratory.

A flow chart of the various processes of fabric preparation is shown in Figure 1.

TABLE I

PHYSICAL ANALYSIS OF FABRICS INVESTIGATED

	Greige		Singe, Desize, Bleach, Dyed		Singe, Desize, Mercerize, Bleach, Dyed	
	Warp	*Filling*	*Warp*	*Filling*	*Warp*	*Filling*
Drill						
Ply	1	1	1	1	1	1
Count	63.5	39.0	68.0	38.0	69.0	37.0
Break	97.0	54.0	93.0	53.0	98.0	51.0
Crimp	6.80	10.0	3.80	15.0	3.40	16.20
Twist	16.7Z	14.2Z	18.5Z	14.4Z	18.4Z	12.7Z
Yarn No.	13.80	14.04	19.60	14.20	18.60	15.38
Gauge	0.018		0.014		0.015	
Weight (oz/sq yd)	5.37		4.71		4.60	
Width	46.6		42.1		41.5	
Sateen						
Ply	1	1	1	1	1	1
Count	96.0	60.0	99.0	58.0	100.0	57.5
Break	162.0	155.0	157.0	141.0	142.0	151.0
Crimp	10.9	8.0	6.60	13.20	6.0	12.0
Twist	19.0Z	9.9Z	20.8Z	9.4Z	22.1Z	9.0Z
Yarn No.	16.0	10.0	19.04	9.09	17.75	9.50
Gauge	0.025		0.021		0.021	
Weight (oz/sq yd)	9.70		8.61		8.73	
Width	40.0		38.0		37.4	
Chafer						
Ply	1	1	1	1	1	1
Count	23.0	23.0	25.0	20.6	25.0	20.6
Break	193.0	186.0	183.0	168.0	207.0	180.0
Crimp	14.20	10.40	5.40	19.20	4.20	19.20
Twist	7.4Z	5.7Z	7.4Z	5.2Z	6.5Z	5.4Z
Yarn No.	2.44	2.78	2.70	2.94	2.82	2.80
Gauge	0.038		0.032		0.032	
Weight (oz/sq yd)	13.61		12.35		12.54	
Width	48.4		44.1		43.6	

DYEING PROCEDURE —— Ten-yard pieces, 6″ wide, were dyed on a laboratory-scale-model pad-steam unit. This dyeing procedure is, no doubt, too well known to the members of this Association to require a detailed description for the purposes of this paper. However, it may be well to mention that after the color had been applied in its pigment form, cloth dried and developed through chemical pad liquor and steam, the sample pieces were rinsed, oxidized and scoured in pots by hand according to normal laboratory procedures.

Each sample of fabric was pigmented with the following dyes at 140° F:

2 oz/gal Vat Yellow GC Paste (CI Pr 9)
2 oz/gal Ponsol Yellow 5GLL Paste (DuP)
2 oz/gal Vat Blue BCS double paste (CI 1113)
3 oz/gal Indigo MLB, double paste (CI 1184)

The composition of the chemical pad solution was as follows:

6.0 oz/gal caustic soda
4.0 oz/gal sodium hydrosulfite
0.2 oz/gal penetrant
5.0% (by volume) color-pigment pad liquor

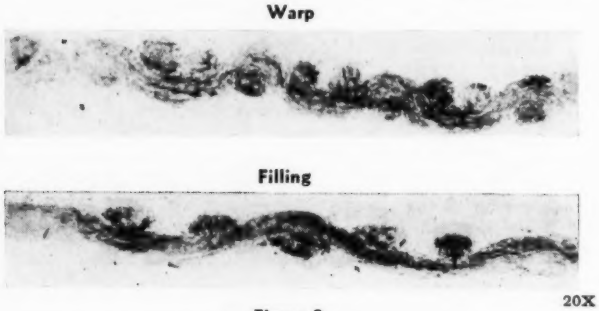
After being steamed for 30 seconds at 214-219° F, the fabrics were processed in open pots in the following sequence:

1) Cold-water rinse.
2) Oxidized with 0.5 oz/gal sodium perborate at 125-130° F for 1 minute.
3) Hot-water rinse.
4) Cold-water rinse.
5) Scoured 2 minutes at 200° F with 0.5 oz/gal synthetic detergent and 0.5 oz/gal soda ash.
6) Cold-water rinse and dried.

EVALUATION OF RESULTS

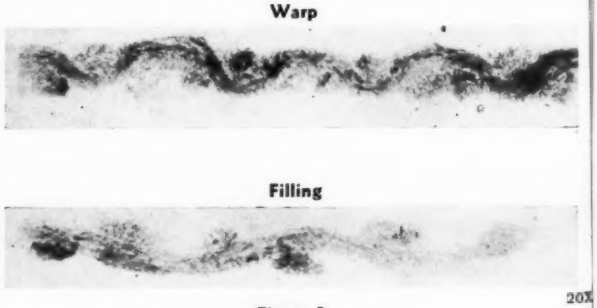
MICROSCOPIC AND PHOTOMICROGRAPHIC EVALUATION——In order to determine visually and to demonstrate the differences that existed in the interior of the three fabrics of different weights, both mercerized and unmercerized, warp-wise and filling-wise microscopic cross sections were prepared.

Since all four dyestuffs evaluated in this paper penetrated in a similar manner when applied to the various fabrics, color slides were prepared for only the set of fabrics



20X

Figure 2
4.7 Oz Drill



20X

Figure 3
4.6 Oz Drill—Mercerized

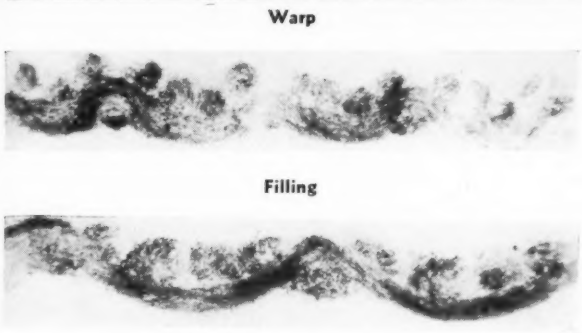


Figure 4
8.6 Oz Sateen

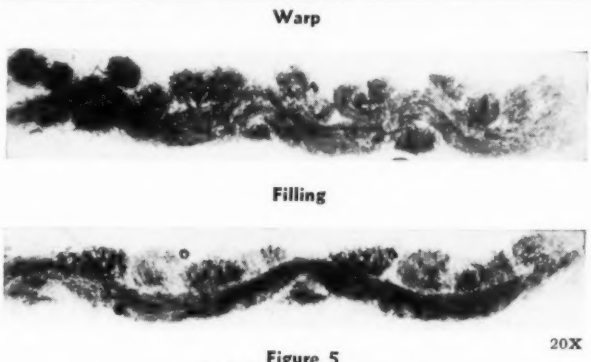


Figure 5
8.7 Oz Sateen—Mercerized

dyed with 3 oz/gal Indigo MLB Double Paste (C I 1184).

(Note: These color slides were presented at the National Convention.)

The photomicrographs shown resulted from the following technique: A½" x 1½" section of a fabric was coated with Neg-O-Lac by pouring this material on the surface of the fabric and allowing it to flow over the surface. It was then allowed to dry under an infrared lamp, recoated and redried until a coating of sufficient thickness (approximately 1/16") was obtained. The coated sample was then inserted in a metal fabric holder, which holds the fabric firmly so that cross sections may be sliced off by a single-edged safety razor blade, a stereoscopic microscope being used to view the sample during cutting. The sections cut were about seven microns in thickness. The sections were placed on a microscope slide, covered with a cover glass and placed in a medium of mineral oil.

The cross sections were photographed with a Bausch and Lomb, Type JMR, Photomicrographic Camera, a tungsten-filament light, a Wratten 78C Filter and Professional Type B Kodachrome Film. Both the warp-wise and filling-wise cross section of a fabric is shown on the same slide. These cross sections were placed on the same microscope slide and photographed together in order to eliminate the possible occurrence of differences in color density during the processing of the transparency.

Figure 2 shows warp-wise and filling-wise cross section of dyed 4.7-oz Drill at 20X.

Figure 3 shows warp-wise and filling-wise cross section of mercerized dyed 4.6-oz drill at 20X. This is same base fabric as referred to above, but, during bleaching, mercerizing and dyeing, the observed weight changed from 4.7 oz to 4.6 oz. Weight changes were also observed with the other two fabrics under consideration.

Figure 4 shows warp-wise and filling-wise cross section of dyed 8.6-oz sateen at 20X.

Figure 5 shows warp-wise and filling-wise cross section of mercerized dyed 8.7-oz sateen at 20X.

Figure 6 shows warp-wise and filling-wise cross section of dyed 12.4-oz chafer at 20X.

Figure 7 shows warp-wise and filling-wise cross section of mercerized dyed 12.5-oz chafer at 20X.

LIGHT FASTNESS——All light-fastness tests were made in a type FDA-R Fade-Ometer according to standard AATCC procedure. Tests were made for 20-hour intervals until decided fading was noticed. The results of these tests are shown in Table II. All light-fastness samples were evaluated in two separate and independent laboratories and the respective ratings agreed very closely.

WASH FASTNESS——Three types of wash-fastness tests were made on each dyed sample. These were as follows:

a) AATCC Wash Test #3—one test.

b) AATCC Wash Test #4—five tests.

c) Five wash-wheel scrub tests were made on each dyed sample. This test is not a standard test for color fastness but is used by various converters for work clothing in determining the fastness for various shades on fabrics that must stand abrasive action in actual end use.

The results of these tests are shown graphically in Table II. All wash-fastness samples were evaluated in two separate and independent laboratories and the ratings from these laboratories agreed very closely.

In order to present visually the comparative data on the degree of fading under the various light and wash fastness tests, exhibits of samples from all the tests on each fabric and dyestuff were prepared.

DISCUSSION OF RESULTS

MICROSCOPIC STUDIES——A com-

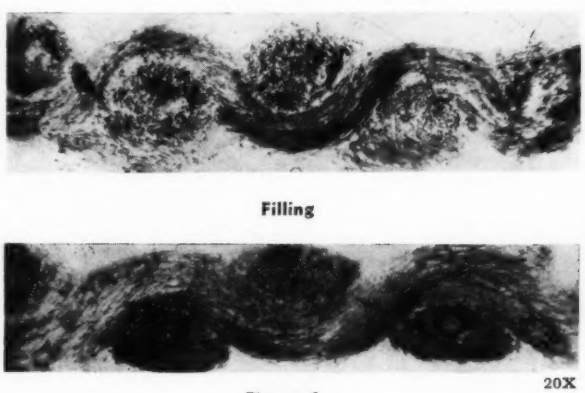


Figure 6
12.4 Oz Chafer

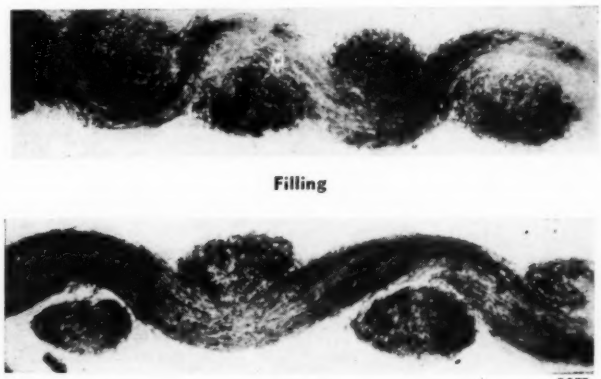


Figure 7
12.5 Oz Chafer—Mercerized

TABLE II

FASTNESS TESTS

Vat Dyes	Ratings Fade-Ometer Light Drill Bl	Drill Bl Merc	Sateen Bl	Sateen Bl Merc	Chafer Bl	Chafer Bl Merc
Vat Blue BCS (C I 1113)	8	8	8	8	8	8
Indigo MLB (C I 1184)	3	3	3	3	3	3
Ponsol Yellow 5GLL	5	5	5	5	5	5
Vat Yellow GC (Pr 9)	2	2	2	2	2	2
Washing, 1 #3 AATCC						
Vat Blue BCS	4-5	4-5	4-5	4-5	4-5	4-5
Indigo MLB	3-4	3-4	4	4	4	4
Ponsol Yellow 5GLL	4-5	4-5	4-5	4-5	4-5	4-5
Vat Yellow GC	4-5	5	4-5	5	5	4-5
Washings, 5 #4 AATCC						
Vat Blue BCS	3-4	3-4	4	3-4	3-4	3-4
Indigo MLB	1	1	1	1	1	1
Ponsol Yellow 5GLL	3-4	3-4	3-4	3-4	3-4	3-4
Vat Yellow GC	4-5	4-5	4-5	4-5	4-5	4-5
Washings, 5 Wash-Wheel Scrubs						
Vat Blue BCS	3-4	3-4	3-4	3-4	3-4	3-4
Indigo MLB	2-3	2-3	2-3	2-3	2-3	2-3
Ponsol Yellow 5GLL	3	3	3	3	3	3
Vat Yelow GC	3-4	4	3-4	4	4-5	4-5

parison of microscopic views of the fabrics agrees well with the visual results shown in the exhibits, which showed that unmercerized fabrics, dyed with the same solutions in the same way, vary in penetration and depth of shade with construction. A similar variation in shade with construction for mercerized samples of varying fabric construction was noted. Also, it was to be noted that, for each single construction, the depth of shade was distinctly greater for the mercerized sample than for its unmercerized counterpart.

Comparison of Figures 2 and 3, Figures 4 and 5, and Figures 6 and 7 reveal the microscopical validation for the visual observation of increased depth of shade with mercerization. In each of these instances the color value throughout the fabric thickness is greater for mercerized fabric; the color resides entirely within the fabric, and not near the periphery of the yarns, as in the case of unmercerized fabric.

FASTNESS EVALUATION —— The light- and wash-fastness evaluations of the various constructions and various applied dyestuffs is tabulated in Table II. Because the results are possibly so unexpected, it is perhaps in order to emphasize two things: 1) these are concordant results from two independent and experienced laboratories, and 2) each evaluation is made in terms of the original shade before exposure and without regard to the absolute depth of that shade.

Comparison of the values that compare the effect of construction of fabric reveals no changes in light-fastness with construction *in each instance.* However, comparison of light-fastness of various dyestuffs on the same fabric construction and preparation presents extreme variation *in each instance.* A comparison of unmercerized fabric with its mercerized counterpart reveals no changes in light fastness with mercerization *in each instance.*

The results in Table II reveal no appreciable effect of fabric construction on wash-fastness, but do reveal slight differences in wash-fastness with dyestuff species. (The tests reveal no appreciable effect of mercerization on wash-fastness.) It appears that Vat Yellow GC (C I Pr 9) is most wash-fast, followed closely by Vat Blue BCS (C I 1113) and Ponsol Yellow 5GLL, and that Indigo MLB (C I 1184) is least wash fast. It has also been proven (by means of five #4 AATCC wash tests) that Indigo MLB (C I 1184) is not at all resistant to chlorine.

CONCLUSIONS

1. The construction of a fabric is markedly influential in the penetration and depth of shade in a standard dyeing procedure.
2. Mercerization improves penetration and depth of shade for a given fabric in a standard dyeing procedure.
3. Light-fastness is a characteristic of the dyestuff itself and is apparently unaffected by fabric construction or previous mercerization.
4. Wash-fastness is a characteristic of the dyestuff itself and is apparently unaffected by fabric construction or previous mercerization.

ACKNOWLEDGMENT

The research committee wishes to express the appreciation of the Southeastern Section to the personnel of the following organizations for their splendid assistance:

American Cyanamid Company—H Gillespie Smith, Matthew J Babey and A L Peiker; Callaway Mills Company—S Jack Davis, Robert Gross, Elbert Fuller, Doris Richardson and Nelle Yates; E I du Pont de Nemours & Co, Inc—Atlanta Laboratory Personnel; Georgia Institute of Technology —Herman A Dickert and Thelma Saggus; Pepperell Manufacturing Company—Alabama Bleachery Personnel.

REFERENCES

(1) Collins, J E, "An Investigation of the Effect of Fabric Construction on the Color Fastness of Vat Dyes Applied to Cotton Cloth." Master's Thesis (1950), Georgia Institute of Technology.
(2) *1950 AATCC Technical Manual and Yearbook,* page 84.
(3) *ibid,* page 128.

Report of New York Section Meeting

February 29, 1952
Hotel McAlpin, New York City

A MEETING of the New York Section was held on Friday evening, February 29th, 1952 at the Hotel McAlpin, New York, N Y, with Paul J Luck, Chairman, presiding. A social hour and informal dinner preceded the meeting.

Introduced by the Chairman were Arthur W Etchells, National Vice-President for the Central Atlantic Region, Edward C Diehl, Chairman of the Philadelphia Section, and Thomas H Hart, Chairman of the Program Committee of the Philadelphia Section. Mr Diehl invited members of the New York Section to attend the meeting of the Philadelphia Section on March 7th at the Penn Sheraton Hotel in Philadelphia.

The Treasurer, James J Marshall, asked for an expression of opinion on the desirability of the McAlpin as a meeting place and it was agreed that it would be advantageous to have future meetings there. He also requested members to get their dinner reservations in early so that adequate arrangements could be made in advance.

The Chairman referred to the program for the March 21st meeting at Fairleigh-Dickinson College.

George L Baxter, Chairman of the National Corporate Membership Committee, discussed the need of corporate memberships and Edmund A Leonard, Alexander Smith & Sons Carpet Co, presented the New York Section Intersectional Contest Paper "The Measurement of Fabric Soiling", which took first place in the Contest last October.

The attendance was about 150.

Respectfully submitted,

NORMAN A JOHNSON, *Secretary*

21st ANNUAL MEETING OF THE INTER-SOCIETY COLOR COUNCIL

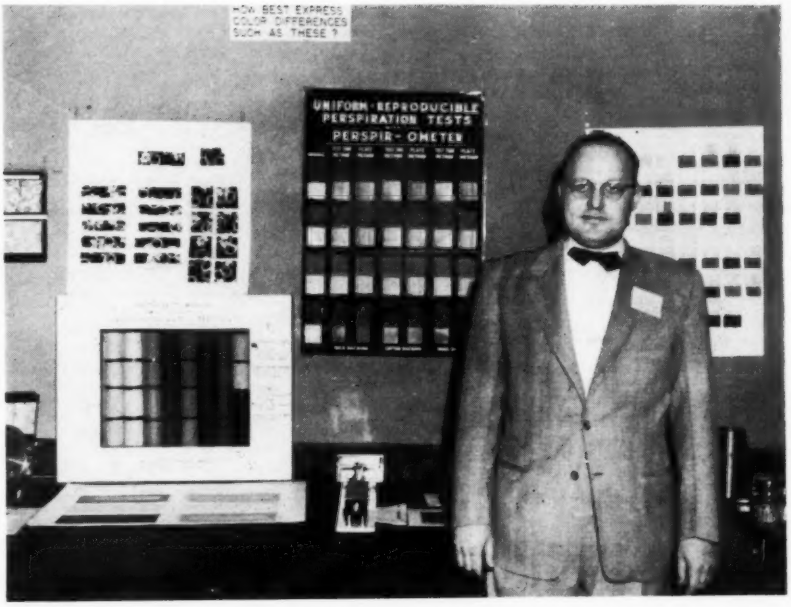
THE 21st annual meeting of the ISCC, held on February 7-9 in the Georgian Room of Hotel Statler, New York, N Y, was unique in being the first one not co-sponsored by one of the 21 national societies which send delegates to the Council and are now together approaching a hundred thousand members. The fifteen scheduled talks and demonstrations covered a wide variety of subjects from Color and Human Efficiency to television in color. During the last demonstration, following the annual dinner, Professor Balinkin of the University of Cincinnati kept his audience laughing constantly with his whimsical sense of humor, as he repeated his famous classroom lectures on the physics of color which had been written up in *Life*.

The talk on color used to promote safety and human efficiency was given by Faber Birren, color consultant and author of several books in this field. He was followed by Professor A C Hardy of MIT, whose Recording Spectrophotometer put America in the forefront of the field of Colorimetry. Prof Hardy spoke on his new process of automatic electronic control of color reproduction. Dr E I Stearns of the Calco Chemical Division gave a fine demonstration of "Dyeing for a Living". His fine sense of humor gave life to his demonstrations of actual dyeing processes accompanied by microscopic slides in color. Dr D B Judd of the National Bureau of Standards reported on the recent Stockholm meeting of the International Commission on Illumination and on the discussion there of certain inadequacies of the colorimetric system adopted internationally by the I C I in 1931. Our British guest speaker, Dr W D Wright of Imperial College, London, pointed out the connections of experiments on color vision and discrimination, such as those for which he is famous, with the activities of people in general in the market places of the world. The color-television demonstration was given by Dr Peter C Goldmark, CBS vice-president, who illustrated his remarks with a commercial set and a special high-fidelity set at the CBS studios.

On the next day's program, illness prevented two speakers from being present; but one of them, the dynamic ceramic artist, Albert H King, of Art Center School, Los Angeles, sent to the meeting six short "abstract" films (some in color) along with his prepared text. Professor Harry Helson, noted psychologist who has been working recently with the Illuminating Engineering Society on the effects of illuminants on color, was unable to send his paper. In this session were two other interesting papers, one on color in oils, by Proctor Thomson of Proctor and Gamble, and one by Kenneth C Welch, Grand Rapids Store Equipment Co, illustrating good and bad illumination effects on color in merchandising.

In the afternoon session Gladys Miller of the American Institute of Decorators presented a well-reasoned talk, "Right Color—Wrong Answer" in which she pointed out that color right from the functional point of view may not satisfy the client from a decorative point of view. Professor Martin Fischer, of the University of Cincinnati, demonstrated the palette worked out by him for the American Artists Professional League to yield paintings that will remain permanent. Ralph M Evans, Eastman Kodak, illustrated his talk on Color in Color Photography with more of the color films for which he is noted, but introduced a new approach to the problem of color harmony by demonstrating that the artist's art principles refer to means for emphasizing the "expressiveness" of the colors combined.

The business session on February 9th was confined to reports by member-body delegations and by working committees. On all three days a number of exhibits dealing with color were on display. The five program sessions were presided over by former chairmen Godlove, Zigler, Evans, Balinkin and Judd, all of whom seemed to regard the meeting as a great success.



Frederick T Simon, Chairman of the AATCC Co'or Research Committee, poses before the Committee's display at the recent Annual Meeting of the Inter-Society Color Council.

HEAD TABLE AT THE BANQUET, FEBRUARY 2ND MEETING, PIEDMONT SECTION WINSTON-SALEM, N C

(L to r): Clarence Hooper, Burlington Mills Corp (General Chairman of the meeting); William R Ivey, Jr, Tennessee Eastman Co; Donald E Marnon, General Dyestuff Corp; Sumner H Williams, General Dyestuff Corporation; Duncan Carmichael, Tennessee Eastman Co; Samuel L Hayes, Ciba Company Inc (National Vice President); Herman Cone, Cone Mills Corp (Banquet Speaker); R Hobart Souther, Cone Mills Corp (Piedmont Section Chairman); J C Whitt, Standard Hosiery Mills (Vice Chairman); Dr Harley Y Jennings, Dan River Mills, Inc (Chairman, Sectional Research Committee); H J Jordan, Wiscassett Mills (Treasurer); A R Thompson, Ciba Company Inc (Custodian); Wilford R Sargent, Scholler Bros Inc; Russell G Lawrence, Rohm & Haas Co.

Annual Winter Meeting Report, Piedmont Section

February 2, 1952

Robert E Lee Hotel, Winston-Salem, N C

THE Annual Winter Meeting of the Piedmont Section was held in Winston-Salem, N C, at the Robert E Lee Hotel, Feb 2, 1952.

The Research Committee met at 10:00 AM, presided over by Dr H Y Jennings of Dan River Mills. Technical papers to be presented by our Section at the National Convention were discussed as well as other pertinent problems relating to our industry. This meeting was well attended; over 50 were present.

Officers, Sectional Committeemen and Councilors met at 1:00 PM for a business luncheon. National Vice-President Sam Hayes and Azel Mack, Secretary of the Northern New England Section were guests.

The well-attended technical session at 3:00 PM featured two papers and discussion, namely:

Duncan Carmichael, Tennessee Eastman Corp, on "Newer Developments in Dyeing of Cellulose Acetate Yarns", and D H Marnon, General Dyestuff Corp, "Marhen Process Relating to Control of Vat Dyeing."

Arrangements for the meeting were handled by Clarence Hooper of Burlington Mills.

The banquet at 7:30 PM, presided over by Hobart Souther, Piedmont Section Chairman, featured a talk by Herman Cone, President and Chairman of the Board of Cone Mills, Greensboro, N C, on "Dangers to Our American Enterprise". Over 200 attended.

Respectfully submitted,

M M McCann, *Secretary*

Herman Cone, Cone Mills Corporation, apparently is describing the familiar "one that got away" to a group that includes (l to r) Duncan Carmichael, Tennessee Eastman Company; Donald E Marnon, General Dyestuff Corp; Piedmont Section Chairman R Hobart Souther, Cone Mills Corp; and National Vice President Samuel L Hayes, Ciba Company Inc. The camera caught the group at the February 2nd meeting of the Piedmont Section in Winston-Salem, N C.

Meeting Report— Mid-West Section

February 16, 1952

Bismarck Hotel, Chicago, Ill

THE Winter meeting of the Mid-West Section was held at the Bismarck Hotel, Chicago, Ill, on February 16.

The afternoon meeting was called to order at 2:30 pm by the vice-chairman, after which he introduced Merrill G Morris of the National Aniline Division, Allied Chemical & Dye Corporation. Mr Morris presented his paper, "The Dyeing of Material for Plain and Face Finished Automobile Fabrics", before approximately 130 members and guests.

Following dinner, which was attended by 120 members and guests, the evening meeting was called to order at 7:45 by the chairman. The secretary's and treasurer's reports were read and accepted, after which Arthur Brainerd, Western Regional vice-president, said a few words. Reports were also given by the chairmen of the Outing and Corporate Membership Committees.

The secretary was instructed to send a message of good wishes and flowers to Elmer Smith.

Following the business session, a film entitled "The Story of Du Pont Research" was shown through the courtesy of the Du Pont Company.

Respectfully submitted,

VICTOR H LAWRENCE, *Secretary*

X-51 Acrylic Fiber——

(Concluded from Page 163)

The dyeing procedure is the same as that described under the section on the staple fiber.

ACID AND DIRECT DYES—Here again no clear-cut distinction can be made between acid and direct dyes. A great many of the dyes from these two classes can be applied to X-51 using the "cuprous ion" method. The dyeing procedure is similar to that described previously.

For continuous filament, the build-up of these dyes is not so good as with the staple fiber. Light to medium shades can be produced.

The fastness properties of continuous filament colored by these dyes are about the same as those for the staple at equivalent depths of shade.

BASIC DYES—Basic dyes will produce some interesting shades on X-51 continuous filament. Since these dyes exhaust very rapidly and don't seem to move after they are applied, a careful control of the initial dyeing temperatures is advisable.

The technique of dyeing is the same as that recommended for the staple. Heavy shades are not advocated because of the possibility of crocking. Light to medium shades do not crock excessively. The other fastness properties are better than would be expected for these dyes on the more conventional fibers.

VAT DYES—X-51 continuous filament, in contradistinction to the staple fiber, cannot be dyed with vat dyes from an alkaline bath. Light to medium shades can be produced by applying these dyes by a modified vat-acid method. The fastness to washing, perspiration, and dry cleaning is excellent. The light fastness is also outstanding. At the present time, however, dyeing costs will be rather high. In spite of the expected high cost, this method of dyeing may find a place for certain end uses of filament yarns.

SOLUBLE VAT DYES—Light to medium shades can be produced by applying soluble vat dyes from a sulfuric acid bath to X-51 continuous filament. The fastness properties of the dyed material are very similar to those obtained by dyeing with vat dyes. Here again, the dye costs will be rather high.

BLENDS—We have accumulated a great deal of information on dyeing X-51 acrylic fiber and are constantly learning newer, better, and easier ways. With this background of information, we have a headstart and are actively investigating the dyeing of X-51 in blends. We feel that for all synthetic staples, blends will continue to become of increasing importance.

May I conclude with a plea on behalf of the dyer? It is addressed to everyone who works with the newer synthetic fibers, X-51 and any others. When selecting your fibers for making blended fabrics, won't you please keep the dyer in mind and not ask for the impossible?

In making this plea I am fully aware that what appears to be impossible today may be possible next year or even next month. With this in mind, the research and application laboratories such as ours in Bound Brook, welcome experimental fabrics of all kinds. But, until the entire industry has learned a great deal more about dyeing fibers which compete with one another for dyes, the dyer will often be placed in a very awkward situation.

Copper——

(Concluded from Page 164)

cent is the effectual fungicide when applied to textiles. Its effectiveness is, however, increased or diminished dependent on the radical to which the copper is coupled and the method of application to the material. Of all the radicals coupled to copper, 8-hydroxyquinoline seemed to have the most effective fungistatic properties. Since $_b$ Coli and $_b$ Typhus seem to be immune to naphthenic acid, no true comparison can be made by phenol coefficiency standards, but the work of Bayer in 1877, followed by that of Fischer and later by Fischer and Koenig (all of which is recorded in abridged form in Beilstein and in *Chemische Berichte)* support the contention that 8-hydroxyquinoline has a greater phenol coefficiency than, and preferable fungistatic characteristics to, naphthenic acid.

The authors cited used not only various compounds but various methods of applying these solutions to their materials. Reasonable consideration, however, indicates that the greatest thread protection can be obtained if the fiber itself is impregnated with the solution, rather than if the fiber or the finished material is merely coated.

The author, investigating the problem, has discovered that fibers can be effectively impregnated with copper solutions, providing the proper emulsion is used in coupling the radical to the copper; and that by using this emulsion, spooled fibers can be treated in a copper 8-hydroxyquinoline bath in such fashion that sufficient copper residue is deposited in every strand by means of the unique penetrating properties of the compound. This method is at once the most effectual and also the cheapest and easiest to use, since properly-treated spooled fibers form the basis for uniformly-impregnated woven materials and sewing thread simultaneously and do away with the slow, cumbersome and costly processes of immersion of yard goods, etc.

SUMMARY

Methods of treating textile fibers to make them fungistatic have been studied over a period of years, more intensely during the last 15 years. Although cotton canvas could be made mildew proof by consecutive immersions in a 10 per cent copper solution and a 10 per cent sodium hydroxide solution, most textile fibers and materials could be treated in various ways with varying results.

Studies made during this period indicate that 0.35 per cent minimal to a 10 per cent maximal deposit of copper precipitated upon or impregnated into textiles or fibers prevents microbiological action. Other preparations with fungicidal properties, such as naphthenic acid, tall oil, oleic acid, 8-hydroxyquinoline and the like do not have sufficient strength and permanence to be used individually for mildew proofing of textiles; but combined as radical elements with copper they produce excellent fungicides. The qualitative value of any of these copper compounds must be appraised, however, not wholly upon the radical used, but in terms of the greatest copper content.

Of all the radicals investigated, 8-hydroxyquinoline appears to lend itself best to the problem. Coupled with a maximal copper content in an emulsion with great penetrating qualities, it is possible to impregnate spooled fibers with optimum uniformity.

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NEWS

• Solvay Plans to Construct New Plant

The Solvay Process Division, Allied Chemical & Dye Corporation, recently announced that it plans to construct a mercury cell chlorine-caustic soda plant on a site of some 400 acres, in the vicinity of Moundsville, West Virginia. Cost of the plant reportedly will approximate $15 million and provide employment for about 125 people.

Salt required for the process is said to be located under the property and the Company has been sinking exploratory wells for several months to determine the extent of the deposit. It is expected that these will be converted to commercial wells and development of new brine wells will commence promptly. Approximately 18 months to 2 years will be required to complete construction of the plant, according to latest estimates.

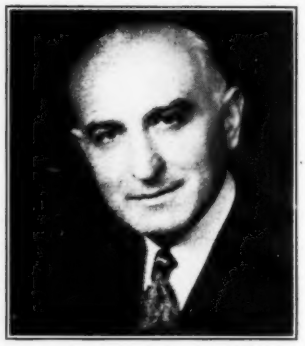
Engineering work in connection with design of the plant will be carried on by Solvay's own forces. The plant will be served by the B & O Railroad. Electric power for the Moundsville plant will be purchased from American Gas and Electric Service Corporation.

• Dates Set for 3rd Canadian Textile Seminar

Queen's University, Kingston, Ontario, has been selected as the site for the third Canadian Textile Seminar, a biennial event that has been sponsored by the Textile Technical Federation of Canada since 1948. September 11, 12 and 13 have been set aside for the meeting, with registration set for the evening of the 10th.

J A Dixon, general chairman, has stated that 500 textile technicans from Canada, the U S and Great Britain are expected at the Seminar, the aim of which is to provide a regular medium through which textile experts of the three nations can exchange information.

Member associations of the Federation include the Canadian Association of Textile Colourists and Chemists, Quebec and Ontario Sections; the Textile Society of Canada, Eastern and Western Divisions; the Ottawa Valley Textile Association, and the Cornwall and District Textile Association.



Al Rappaport

• Dexter Acquires Lake Chemical

The acquisition of Lake Chemical Corporation, including rights to all former Lake trademarks and tradenames, has been announced by the Dexter Chemical Corporation, New York. It is learned that the Textile Chemical Division plans to produce the products formerly offered by Lake, in addition to its own line of processing agents.

Although the early contributions of the Lake concern were largely in the development of specialized textile chemicals for the wool industry in Northern New England, the firm more recently had been specializing in detergents, wetting agents, finishes and other processing assistants used primarily by the dyeing and finishing industry in the New York and New Jersey areas.

Al Rappaport, Eastern Sales Manager for the Lake concern, will be retained by Dexter as sales representative in the Metropolitan New York area. Mr Rappaport, an AATCC member, was at one time purchasing agent for All-American Textiles Company and sales representative for Coffette Products.

• New Hart Products Plant

The Hart Products Corporation, manufacturers of textile chemicals, have announced a $400,000 expansion plan, including the modernization of an 80,000 square foot all-brick building in Jersey City, N J, which will be the site of their new plant and laboratories. Alterations and installation of equipment are scheduled for completion by June.

• Aniline Expansion Goal

A goal for the annual domestic production by 1954 of 135 million pounds of aniline, exclusive of capacity of plants in the National Industrial Reserve, was announced last month by Ralph S Trigg, Deputy Administrator of the Defense Production Administration for Program and Requirements.

This is an increase in capacity of about 28.6 million pounds over the January 1, 1951, capacity of 106.4 million pounds which privately-owned plants were able to produce, according to Mr Trigg. Of the 28.6 million pounds of increased capacity, 13 million pounds will reportedly represent unaided private investment, and the remainder, private investment assisted by the Government through rapid tax amortization.

Expansion of capacity for the production of aniline is said to be required principally because of the need for rubber processing chemicals. Requirements for such chemicals have been greatly increased due to the production and use of a high proportion of synthetic rubber in the defense program, and also because of the stockpiling of natural rubber.

It is estimated that 54 percent of the aniline production is used as the basic material for the manufacture of rubber chemicals and 22 percent is required for making dyestuffs. Some increase in the production of dyestuffs requiring aniline is expected to come from activities connected with the defense program.

• Monsanto Ups Resloom HPS Production

Substantial expansion of production capacity for Resloom HPS, a dry powder melamine resin for textile finishing, is being undertaken by Monsanto Chemical Company.

H J Heffernan, general manager of sales of Monsanto's Merrimac Division, in announcing the expansion, said the increase was authorized to keep pace with increasing consumer demand for this type of melamine resin.

"Resloom has been adopted as standard by finishing mills," Mr Heffernan stated, "as a most effective agent for developing permanent embossed effects on cotton fabrics." The resin is also an important chemical agent for the stabilization of woolen, worsted and rayon fabrics.

• Seminar on Wool Research Project Results to be Held at LTI

Wool scientists in direct charge of various phases of the International Wool Research Project will discuss the project during a seminar to be held April 7 through 9 at the Lowell Textile Institute, Lowell, Massachusetts, under the auspices of The Wool Bureau, Inc.

Papers will be presented by members of the staffs of the Textile Research Institute and the Forstmann Woolen Company laboratories who directed each phase of the study. Ample opportunity will be afforded for questions and discussions from the floor.

The 3-day program will be inaugurated with a welcome by Martin J Lydon, LTI president, and introductory remarks by F Eugene Ackerman, president of The Wool Bureau, Inc. The first day will be devoted to fundamental fiber properties, the second to mechanical processing, and the third to dyeing, finishing and special physical tests.

J H Wakelin, TRI director of research, will preside over the third day's activities, which will feature the following topics:

"Dyeing and Finishing Master Wool Fabrics"—William Brommelsiek, technical advisor for production, Forstmann Woolen Company; "Properties of Finished Fabrics"—C S Clutz, research physicist, Forstmann Woolen Company; "Special Physical Tests on Yarns and Fabrics"—C S Clutz and H M Burte.

Representatives of the wool textile industry and those interested in wool science and technology are invited to attend. Through the cooperation of Mr Lydon, accommodations for visitors will be available in the LTI dormitories. Further information may be obtained from Giles E Hopkins, technical director, The Wool Bureau, Inc, 16 West 46th Street, New York 19, New York.

H D Armitage, Emery Industries' New York district manager presents two-suiter to Philip C Moreau, winner of Emery naming contest. R J Roberts looks on.

• Moreau Wins Emery Contest

PHILIP C MOREAU, technical service representative for the Corn Products Sales Co, has been named the winner of a contest involving the naming of the Emery Industries ball-man trademark currently being used. The contest was sponsored by Emery Industries at the recent Chemical Industries Exposition in New York. Mr Moreau was selected by Ruthrauff & Ryan, advertising agency of Emery Industries, on the basis of originality and connection with Emery Products.

• Blumenthal Sponsoring Installation of TRI Conference Room

Sidney Blumenthal & Company, Inc, is assuming the entire expense of installing and furnishing a special Industry Conference Room in the new Textile Research Institute laboratory building in Princeton, New Jersey. In addition to the construction costs of the room, the gift includes carpeting, furniture and all other necessary equipment.

Correction

Re: Article on Rodney Hunt "52" Dye Beck

In the discussion of the Rodney Hunt Machine Company's new line of Series "52" Dye Becks on page 120 of the Feb 18 issue, it is stated that, "In the '52', the need for *a wrapping reel* is eliminated". The statement should correctly read, "the need for wrapping a reel is eliminated".

Advantages of the unit should include "new door construction allowing door to slide up overhead or in flush with front partition exposing only *front* compartment for chemical additions" and "'Film-Flow' water *inlet* for introducing even films of water across tub front".

• Dow Establishes Microbiological Lab

The establishment of a microbiological laboratory as a section of the biochemical research department, Dow Chemical Co, has been announced by Dr D D Irish, director. Dr Paul A Wolf, a member of the biochemical research department since 1942, has been placed in charge of the new laboratory.

Efforts of this section will be directed toward the development of new germicides and fungicides for control of bacteria, molds and yeasts that cause deterioration to industrial and agricultural products, including textiles.

In addition to the development of new products for these fields, this laboratory will conduct a continous study of methods by which the Dowicides and other Dow preservatives can be used to better advantage.

Dr Charles G Humiston, Dr Robert L Johnson and Willard M Westveer are to be associated with Dr Wolf in the microbiology laboratory.

NAMES IN THE NEWS

DR EDWIN A MEIER, technical assistant to the plant manager at the Grasselli plant, General Aniline & Film Corp, was honored on January 31st with a testimonial dinner at the Elizabeth Carteret Hotel (Elizabeth, N J). Dr Meier, head of the Sulphur Colors and Textile Auxiliaries department at Grasselli for more than 25 years, retired on that date after more than 33 years service.

Company executives, supervisors and a number of employees associated with Dr Meier for more than 30 years paid tribute to the retiring industrialist at the affair. Among the speakers were Acting Plant Manager RUSSELL L McKNIGHT; ERNEST KUHN, superintendent, Sulphur Colors Area; WILLIAM C WILHELM, supervisor, Analytical Laboratory; and JACKSON J AYO, JR, research coordinator. Mr Kuhn was toastmaster.

A resident of Cranford, N J, since 1918, Dr Meier came to the United States from his native Switzerland the previous year. After his arrival he joined the Standard Aniline Works, Wappingers Falls, N Y, where he supervised the manufacture of sulfur and azo dyes and dyestuff intermediates. In September, 1918, he accepted the post of plant chemist at Grasselli Chemical Company, predecessor company of General Aniline.

A NEW technical superintendent and three new production supervisors were appointed for the Acrilan manufacturing plant of the Chemstrand Corporation during February, according to announcements by F William Koster, plant manager and secretary. ROBERT H HELLE, former supervisor of Chemstrand's pilot plant at Marcus Hook, Pa, will, as technical superintendent, be in charge of process control, analytical and textile laboratory technicians, and chemists and chemical engineers engaged in process development. As such he reportedly will operate in close co-ordination with the company's research and development center in applying new techniques to operating procedures within the plant.

The three new production supervisors include COLE DOWNING, ROBERT J LARSON, and ADIN A NELLIS, JR.

William J Carlin

WILLIAM J CARLIN has joined the fatty acids sales staff of W C Hardesty Co, Inc and will operate in the Middle Atlantic states. He was formerly with E F Drew & Co.

SEWALL D ANDREWS has been named general manager of the Chemical Division of General Mills.

Mr Andrews, who has served as director of sales, reportedly will continue to head that activity and in addition will assume responsibility for all Chemical Division operations. Before joining the division, he served as director of purchases. Mr Andrews is a 20-year veteran with General Mills.

DR ROGERS B FINCH, assistant professor of textile technology and director of the Slater Memorial Research Laboratory at the Massachusetts Institute of Technology, has been appointed as an engineering education consultant to the Mutual Security Agency.

Dr Finch left for Burma on Feb 27th, it is learned, to consult with the Ministries of Education and Industry relative to the engineering program of the University of Rangoon and the Government Technical Institute. Upon his return (reportedly about April 7th) he will resume his duties at MIT and serve as educational advisor under a cooperative program between the University of Rangoon and MIT sponsored by the MSA.

During his return trip from Burma, he will spend several days in Tokyo, Japan, conferring with representatives of the Occupation, the Ministry of Education, and the Japanese Institute for Engineering Education which was organized following the visit of an Engineering Education Mission to Japan last summer in which Dr Finch participated.

Among his diversified activities, Dr Finch is the newly-appointed Chairman of the AATCC Technical Program Committee.

L Vincent Neese

TWO recent appointments of the Rodney Hunt Machine Company include a sales engineer in the South (L VINCENT NEESE) and a field service engineer in the Textile Machinery Division (CHRISTOPHER C GANOS). Mr Neese, a native of Atlanta, joins A P Hyde at the Company's Southern Region Office in Charlotte. Mr Ganos has been with the Company since 1947, most recently as a supervisory erector.

Christopher C Ganos

GUSTAV EGLOFF, director of research for Universal Oil Products Company, has been named honorary chairman of the Second International Art Exhibit planned as part of the Seventh National Chemical Exposition.

The Exposition, biennial parade of chemical progress, will be held in the Chicago Coliseum, Sept 9-13, 1952. The art exhibit, limited to the work of chemists, was first staged in 1950 as a part of the sixth exposition. SEYMOUR GOLDFARB, Scientific Oil Compounding Company chemist and a modernist painter in his own right, served as the original chairman and will again have active charge this year.

Dr Egloff's duty as honorary chairman will be to attract as many exhibits as possible.

H W Firsching

COMMONWEALTH Color & Chemical Co, New York, has added H W FIRSCHING as a regular member of their sales staff. Mr Firsching, who was formerly associated with Montgomery Mills, Inc, as superintendent of dyeing, began his duties as a salesman-demonstrator in New York, New Jersey and Pennsylvania on March 3rd.

DONALD L TAYLOR has been appointed manager of general developments, in the development and research department of Hooker Electrochemical Company, according to J H Babcock, vice president in charge of development and research. Mr Taylor will be concerned with general expansion of the company's operations such as investigation of new plant sites, raw material surveys, and other studies of a general economic nature.

Other recent Hooker appointments include:

In the Development & Research Department——ABRAM DAVIS, as a research chemist and BERYL B McKOWN, as a technician in the physical laboratory.

In the Engineering Department——THOMAS HOOKER, as chemical engineer, WILLIAM F HARVEY, as a mechanical engineer, and EDWARD J KALETA, as a draftsman.

JOHN WILSON, Rhode Island Section (AATCC) publicity director, has joined the Owens-Corning Fiberglas Corporation in Ashton, R I. He was formerly with the General Dyestuff Corporation.

THE appointment of WILLIAM M SHINE as director of market development for Arnold, Hoffman & Co, Inc, Providence, R I, has been announced by W Chester Cobb, vice president in charge of sales. Mr Shine has been connected with Arnold, Hoffman since June, 1950, working in plastics sales and market research. He had previously been with General Aniline and Film Corporation in sales development and research work. In his new position, he will continue to work out of the Company's New York office.

R B Fiske

HERBERT B WOODMAN, President of the Interchemical Corporation, has for the fifth consecutive year accepted the chairmanship of the Chemicals and Paints Divisions of The Legal Aid Society's annual Fund Raising Campaign. Working with him will be ROBERT BISHOP FISKE, Vice president and Director of American Cyanamid Company, who will serve as co-chairman of the Chemicals Division. The announcement was made by R Gordon Wasson (Vice President, J P Morgan & Co, Inc), General Chairman of the 1952 Appeal.

W S KUMBLAD, Socony-Vacuum Oil Company, Inc, has been transferred to the company's New York office, 26 Broadway, as headquarters staff engineer for Socony-Vacuum Process Products used by the textile and paper industries.

Mr Kumblad formerly served in the Boston office as Process Products representative for New England. In his new duties he replaces W A BEMAN who is now in charge of the company's chemical products section.

DR WILLIAM B BROWN, formerly plant manager for the Pittsburgh Coke and Chemical Co, has been appointed manager of General Mills' chemical plant at Kankakee, Ill, according to an announcement by Whitney H Eastman, president of the Chemical Division.

In his new position, he will be responsible for production of General Mills' fatty acids, polyamide resins and other organic chemicals.

DR CLARENCE P HARRIS has been engaged as director of research at the Elizabethport, N J, plant of the Apex Chemical Co, Inc, of New York, N Y. Dr Harris is a specialist in the field of textile chemical auxiliaries, having been employed by various organizations in the past as well as having conducted his own laboratory.

Paul M Bigley

PAUL M BIGLEY, who was granted a three-months' leave of absence from Wyandotte Chemicals Corporation to serve the Office of Price Stabilization, has been released to resume his duties at Wyandotte Chemicals. Upon special request, he voluntarily extended his service with OPS to the ten-month period, ended February 11, 1952.

Mr Bigley is assistant to the general sales manager of the Michigan Alkali Division.

RICHARD T CLARK has been appointed sales manager of Monsanto Chemical Company's textile chemicals department in Everett, Mass, one of several changes in the Merrimac Division sales organization effective March 1. THOMAS F GOGAN succeeds Mr Clark as New York Branch Manager for Merrimac Products, DANIEL P SHEDD has been transferred from the sales development department to sales representative for Southeastern New England, and ROBERT J JOHNSON has moved from the division's engineering department to the technical service section of the sales department.

In St Louis, WINTHROP R COREY has been named manager and JAMES E CRAWFORD, JR, assistant manager, of phosphates and detergent sales for Monsanto's Phosphate Division. The group of products for which Mr Corey will be responsible includes elemental phosphorus, phosphoric acid and its various salts, in addition to the division's line of synthetic detergents and wetting agents. Mr Crawford will aid primarily in the sale of Steroxes and Santomerses, synthetic detergents and wetting agents for household and industrial purposes.

DR ROBERT L JOHNSON has joined the Dow Chemical Company's Biochemical Research Department in Midland, Mich. He reportedly is working in the Microbiological Laboratory, which specializes in the use of chemical compounds to combat microbial deterioration of industrial products.

Chester U Stevens

THE appointment of CHESTER U STEVENS to the research staff of the Crown Chemical Corporation has been announced by Walter E Murray, president. From 1947 until the present, Mr Stevens was in the Research & Development Division of the Lonsdale Company. Prior to that he spent twelve years in a similar division of the Carter's Ink Company, after a year with National Aniline.

DU PONT personnel moves during February included the following:

Polychemicals Department —— JERRY D SHAW has been appointed manager of a new marketing sales section, which will combine functions of the former market studies, sales records and analysis, and production coordination sections. Mr Shaw's former position, manager of sales to the paper, textile and leather industries is now filled by STUART P MILLER, former assistant manager. Dr ALBERT A PAVLIC was moved up to succeed Mr Miller, and FRED E WINTZER was promoted to Dr Pavlic's place as market studies supervisor. At the same time, ROBERT R WARNER was advanced to the position of new product development supervisor in the place of EVERETT B YELTON, recently transferred to the Production Division.

Organic Chemicals Department —— Three members of the Dyestuff Division have been named to new sales posts: C HARRELL ASBURY was named assistant manager, domestic sales; HEINZ A LIPS was appointed manager, lakes, paper and leather section; and KENNETH C JOHNSON was named manager, textiles section.

Textile Fibers Department——Dr LAWTON A BURROWS, former manager of the technical division of the Explosives Department, transferred on Feb 11 to the post of general technical director of the Textile Fibers Dept. Dr CHILES E SPARKS is now director of nylon (and "Dacron" polyester fiber) research, moving up from assistant director. JAMES R KELLY has been named planning manager of the manufacturing division for "Dacron".

A C Paulson

THE appointment of A C PAULSON as manager of the St Paul Branch of the Crucible Steel Company of America, was announced recently by W H Wiewel, vice president in charge of sales.

Mr Paulson joined the Crucible organization in 1924. His last assignment was as District Representative in Rockford, Illinois.

DR L G NUNN has been advanced to the staff of the Antara Chemicals Division, Technical Department, where he will devote himself to Antara's program of providing technical service to the chemical customers of General Dyestuff Corporation, sales distributor for General Aniline & Film Corp.

Dr Nunn joined the Central Research Laboratory of GAF in May, 1950.

COLONEL CHARLES F H JOHNSON, president of Botany Mills, Inc, recently announced the appointment of HARRY C TEMPLETON as vice president in charge of all production and as assistant to the president of Botany.

Mr Templeton has been General Superintendent of Botany Mills for the past eight years. Prior to that he was Resident Manager of the American Woolen Company mills at Maynard, Mass, and was associated with the New York selling offices of the company.

AT THE recent Annual Meeting of the Board of Directors, Stein, Hall & Co, Inc, New York, elected ROBERT STRASSER executive vice president and JOSEPH C BLAUVELT, SADIE FELDMAN and DANIEL H LIPMAN vice presidents. ERNEST RUSCH was elected assistant vice president.

LAWRENCE GUSSMAN, vice president in charge of manufacturing and technical research, was elected president of The Stein-Davies Company, a manufacturing subsidiary of Stein, Hall located in Long Island City. S CRAWFORD BONOW was elected assistant vice president and FRANK G FACKLER was named plant superintendent of Stein-Davies.

LIONEL A ROBERTS, superintendent of dyeing and finishing with the Valley Lace Company (R I) for the past 18 years, and vice-president of the firm for nine years, announced his resignation on Feb 21st, it is learned.

GEORGE E RICHES, president of Riches-Nelson, Inc, 342 Madison Ave, New York, N Y, has announced that RICHARD J RITCHIE is now associated with the firm. Mr Ritchie most recently was vice president of Pepsi-Cola Company in charge of chemical laboratories and the production of syrups and concentrates.

JAY HARRIS, chemical engineer, has been appointed chief of the Chemical Branch, Engineering Division, New York Chemical Procurement District, Chemical Corps, New York, N Y. This Branch is concerned with the chemical engineering aspects in procurement and production of chemical warfare material. It also acts as a consultant in the development of technological production programs.

Irving B Remsen, Jr

IRVING B REMSEN, JR, formerly a division engineer of American Viscose Corporation, has joined the headquarters engineering staff of Hall Laboratories, Inc, Pittsburgh, Pa, for work as technical consultant on waste water problems in the industrial, municipal and utilities fields.

His work at American Viscose was in developing waste and water treatment at the firm's various plants. Previously he served four years in technical sales with Filtration Engineers.

OBITUARY

Dudley B Setzler

DUDLEY B SETZLER, 41, division representative of the Dexter Chemical Corporation in Georgia, Alabama and Tennessee, died in Columbus, Ga, on January 12.

Mr Setzler had been with Dexter for four years and had previously been a textile chemist with numerous companies including American Enka Corporation and Hartford Rayon Company. He had recently moved his family from Rome, Georgia to Atlanta, and was on a business trip when death occurred.

He was a member of the AATCC, Southeastern Section.

MORRIS E LEEDS

MORRIS E LEEDS, founder and chairman of the board of Leeds & Northrup Co, Philadelphia manufacturers of electrical instruments and automatic controls, died on February 8 in Lake Wales, Fla, at the age of 82.

Among his many honors, Mr Leeds' industrial relations achievements earned him the Henry Lawrence Gantt Medal of the Institute of Management, while his scientific work earned him medals for the development of instruments and controls (probably the most noted of which was the ultimate Leeds Recorder, the first balance-method industrial recording instrument).

OSCAR R FLYNN

OSCAR ROGERS FLYNN, chief chemist for the Waldrich Company, silk dyers and finishers in Delawanna, N J, whom he had served for 46 years, died in Roosevelt Hospital, New York, on February 6. He was 79.

Mr Flynn, an active member of the New York Section, AATCC, since its earliest days, was noted for his extensive work in the field of light-fastness and was instrumental in the development of the mercury-arc.

TECHNICAL LITERATURE

Burkart-Schier Chemical Company—Plants · Personnel · Facilities

Burkart-Schier Chemical Co
Chattanooga, Tennessee

The avowed purpose of this book, on the part of Burkart-Schier, is to tell their customers something of the plant, the personnel and the facilities of the Company. This is aptly done with numerous photographs of the Burkart-Schier "family", complete from president C A Schier on down, as well as various views of their two major divisions; research control and technical service laboratories; sales offices and other facilities.

Burkart-Schier was established in August, 1922. In 1926 the Textile Manufacturing Division was begun, this unit of the company celebrating its 25th anniversary in May, 1951. A branch of the company was opened in Nashville in 1937 and another in Knoxville in 1941. A new and modern plant, replacing old facilities, has just been completed in Knoxville.

The Chemical Division and the Manufacturing Division comprise the two major segments. The Chemical Division distributes a complete line of industrial and textile chemicals as well as a great number of special items. Large stocks are carried in Knoxville and Nashville, as well as in Chattanooga. The plant and laboratories of the Manufacturing Division are located in Chattanooga where control, technical service and research laboratories are maintained. A full range of textile auxiliaries or wet-processing agents is made, and sold throughout the country.

UC&C Technical Information Bulletins F-7830, F-7831, and F-7832

Carbide and Carbon Chemicals Co
Union Carbide and Carbon Corp
30 East 42nd St, New York 17, N Y
Available on request

F-7830 indicates a potential use for 2, 5-Dimethyl Piperazine, an alicyclic disecondary amine now available in pilot plant quantities from Carbide and Carbon Chemicals Co, as an intermediate in the synthesis of textile-finishing agents, resins, boiler-treating compounds, etc.

F-7831 describes the physical and chemical properties, shipping data and suggested uses of a new ethanolamine—N-Ethyl Ethanolamine—now available from C and C in commercial quantities. Derivatives of N-Ethyl Ethanolamine reportedly find application as emulsifying agents, insecticides, and fungicides. The product is also said to be of potential value as a dyestuff intermediate and for the synthesis of resins.

F-7832 includes properties, shipping data, uses, and potential applications for another new commercially-available C and C product —— N-Butyl Diethanolamine. It is stated that this product may be used to introduce the tertiary amido group into a molecule, a manner in which cationic surface-active agents (useful in finishing processes) may be prepared. The condensation product of this amine and N,N-bis (methoxymethyl) urea is reported to be useful as a stabilizer for dyestuffs, whereas the amine itself is of potential value for synthesizing them.

Caustic Soda (Bulletin No. 6) and Liquid Chlorine (Bulletin No. 7)

Solvay Sales Division
Allied Chemical & Dye Corporation
Advertising & Sales Promotion Dept
40 Rector Street
New York 6, N Y
Available on request (U S and Canada)

These are new, revised editions containing many revisions and additions to the material of the widely-circulated previous editions.

Bulletin #6, "Caustic Soda", includes chapters on Properties and Solutions, Handling and Dissolving, Nature and Advantages of Liquid Caustic Soda, Unloading and Handling Liquid Caustic Soda, and General Information, in addition to conversion tables, glossary and index. This edition (the fourth) includes many new tables, illustrations and a chart of precautions.

Bulletin #7, "Liquid Chlorine", consists of chapters on Properties of Chlorine, Liquid Chlorine Containers, Safe Handling of Chlorine, and Equipment and Accessories, in addition to many illustrations, tables, an index and a procedure to be followed in case of accidents.

Acrilan "Created by Man"

The Chemstrand Corporation
Decatur, Alabama

This booklet describes the facilities and employee requirements of Chemstrand Corporation, jointly-owned subsidiary of the American Viscose Corporation and Monsanto Chemical Company, in addition to devoting considerable space to the properties and processing of "Acrilan" fiber. Mention is also made of the Company's agreement with Du Pont to produce and market nylon.

Sorbit

Alrose Chemical Company
Box 1294
Providence, R I
Available on request

The specifications, properties and applications of this sodium alkyl naphthalene sulfonate surface active agent in both flake or paste form are covered in this technical bulletin. Sorbit P, the flake form, is said to contain a small amount of polysulfonated alkyl naphthalene sulfonate not present in Sorbit AC, the paste form. In general, however, the properties of the two products are identical, making due allowance for the difference in sodium sulfate content.

In addition to pointing out Sorbit's general specifications, the bulletin discusses the product in regard to solubilization, foam, emulsification, detergency, wetting, and biological properties.

Applications of the product to detergents, disinfectants, hydrotrope applications, textiles, metal processing, polymerization, and fire control are pointed out.

Vacuum Pressure Impregnating Systems

Process Industries Engineers, Inc
Manufacturing and Construction Div
Pittsburgh 6, Pennsylvania

This bulletin should be of interest to those treating materials for waterproofing, fireproofing and insulating by methods employing the vacuum-pressure cycle or any part of it.

A typical arrangement of the parts of a PIE package unit is illustrated, along with variations. Specifications, application data, operational procedure and discussion of parts are included.

How to Build Corrosion-Resistant Floors

U S Stoneware Co
Akron 9, Ohio
Available on request from Stanley Powers

The means to construct acid-proof brick floors are described in detail in this bulletin (AB17), which includes the uses of acid brick, the application of different types of cement, shows detailed drawings of various types of floors, as well as actual installation photos. Installation instructions and answers to typical questions are also covered in this 16-page booklet.

Properties and Uses of Hercules CMC Cellulose Gum

Hercules Powder Company
Wilmington, Delaware

This booklet, which describes the important applications for Hercules CMC as well as its physical and chemical properties, is intended to give the reader an indication of how the product might help to solve individual technical and economic problems.

Hercules reportedly is the only company which manufactures both the purified and technical grades of CMC. Information on types available, viscosity, compatibility, and other pertinent data is contained in the booklet. A bibliography lists most of the published literature appearing in recent years pertaining to the chemical.

Barnstead Bantam Water Demineralizer Bulletin

Barnstead Still & Sterilizer Co
148 Lanesville Terrace
Forest Hills, Boston 31, Mass
Available on request

This bulletin (#124) describes the seven new features of Barnstead's Water Demineralizer for laboratories, including the direct reading type meter. The unit reportedly connects directly to any water supply and delivers the demineralized water in continuous flow from 5-8 gals/hr.

TS-S112, Recommended Commercial Standard for Wool Felt

Commodity Standards Division
Office of Industry and Commerce
U S Department of Commerce
Washington 25, D C
(Available on request from H A Ehrman)

The purpose of this commercial standard is to serve as a guide to manufacturers and others in the production, sale, or use of wool felt. It covers minimum physical and chemical requirements for mechanical roll felts, sheet felts, and roll felts for the apparel and decorative trades. It does not include punched, woven, synthetically-bonded, stitched, quilted, paper, or other materials of felt-like appearance which are products of entirely different construction.

The mechanical roll felts covered by the recommended standard are typical in type, weight, and other specifications with the Society of Automotive Engineers, the American Society for Testing Materials, and the Felt Association felt standards. The sheet felts conform with the essential requirements as adopted by The Felt Association and the ASTM.

Witco Report (P-17) on Mildewproofing Agents

Witco Chemical Company
295 Madison Avenue
New York 17 N Y
Available on request

Witco Chemical Company is now issuing a 12-page Technical Service Report on Mildewproofing Agents with emphasis on 8 per cent copper naphthenate and other chemicals with respect to Government Specifications.

A brief description is given of the methods used for mildewroofing materials and some of the products used for this purpose, together with abstracts of many of the government specifications on mildewproofing requirements. Also included is an index of the specifications abstracted so that any particular specifications can be easily located.

Cotton From Field to Fabric

National Cotton Council
P O Box 18
Memphis 1, Tennessee
$3.25 per copy

The National Cotton Council reports that it has already distributed over 2,500 copies of this recently-published reference book, which tells the over-all story of cotton — cultivation, harvesting, ginning, grading, spinning, weaving and finishing. A special section displays 112 actual swatches of cotton fabrics, ranging from basic gray goods to a variety of finished types.

Belt Gravimetric Feeder (Bulletin No. 35-F5B)

Omega Machine Company
345 Harris Avenue
Providence 1, R I
Available on request

Omega Machine Company, one of the B-I-F Industries, has issued this four-page bulletin to describe their Belt Gravimetric Feeder, which reportedly makes possible the continuous weighing and feeding of dry materials at capacities of from 100 to 100,000 lbs/hr.

The bulletin lists the many features of the feeder, describes the operation of the vibratory feeder, weigh belt, scale beam and all other pertinent parts. It also illustrates the mechanism with photographs and diagrams.

Among the advantages found in feeding and weighing dry materials with the Omega Belt Gravimetric Feeder, the bulletin lists its simplicity, accurate scales, accurate feeding, wide range, totalizer, accessibility, electrical controls, illuminated alarm and ease of testing. Accessories permit handling of floodable-finely-pulverized materials, it is stated.

Review of Textile Progress Volume II

The Textile Institute
10 Blackfriars Street
Manchester 3, England
Price: $3.50

25 experts in their respective fields contribute to Volume II, which relates particularly to the years 1950-51. Compilation and publishing were a joint venture of the Textile Institute and the Society of Dyers and Colourists.

Following an introduction by G S J White, Chairman of the Joint Committee, the book is devoted to the following subjects: Physics and Chemistry of Fibrous Materials; Fiber Production; Fabric Production; Coloring Matters; Coloring of Textiles; Finishing; Analysis, Testing, Grading and Defects; Laundering and Dry Cleaning; and Building and Engineering.

Prufcoat Technical Bulletin No. 501

Prufcoat Laboratories, Inc
50 East 42nd Street
New York 17, N Y
Available on request
G Russell Hersam, gen'l sales mgr

Prufcoat Laboratories, with over 12 years of experience in formulating synthetic resin protective coatings for controlling corrosion, shows in chart form the resistance ratings of some 69 corrosive chemicals of various types of Prufcoat, including the Standard Series, the "A" Series, and Prufcoat BX White Enamel.

Dresinol

Hercules Powder Company
Wilmington, Delaware

Revised information about a series of resin emulsions containing 40 to 45 per cent solids is available in this new leaflet.

These low-priced resin dispersions are said to be compatible with animal glues, starch, dextrins, corn and soybean proteins, water dispersions of phenol- and urea-formaldehyde resins, and casein.

There are ten types of Dresinol and with one exception, Dresinol 155, these emulsions reportedly have limited compatibility with synthetic rubber latices and polyvinyl acetate and chloride. Dresinol 155, however, is said to exhibit excellent compatibility with all of the latter group of dispersions plus natural rubber latex.

The properties imparted by Dresinol suggest its use in laminating, heat-sealing, and wet-type adhesives; emulsion paints, coatings and sizings; industrial fabric finishes; and binders for various types of fibrous and inorganic materials.

Esters (Bulletin F-4766)

Carbide and Carbon Chemicals Co
30 East 42nd Street
New York 17, New York
Available on request

In addition to discussing the uses, physical properties, and shipping data on more than 30 esters that are sold by the Company, this booklet describes the solubility of various resins in some of the esters as well as their performance in nitrocellulose lacquers. Also included is a bibliography listing the important references to esters in chemical literature.

An important feature of this new booklet is a section covering the specifications of the esters as they are shipped. This section is complemented by a complete description of the control tests that are recommended by the Company for determining these specifications. The control tests are the standard ASTM methods as well as new methods that have been developed in the Company's own laboratories.

Corrosion-Resistant Fittings Catalog

Horace T Potts Company
Erie Ave and D Street
Philadelphia 34, Pa
Available on request

The exclusive features of Speedline corrosion-resistant fittings now available in several stainless analyses are described in this 20-page catalog. Types and sizes are illustrated.

Penfield Mono-Bed Demineralizer

Penfield Manufacturing Co, Inc
19 High School Avenue
Meriden, Connecticut
Available on request: write to
Edward H Clohessy, general mgr

Included in this catalog sheet are: (1) a picture of the unit; (2) a diagram with parts lettered and identified; (3) a description of the parts; (4) a specifications chart; and (5) a performance chart from which potential users can estimate their operating costs.

Penfield Mono-Bed Demineralizers are said to operate on intimately mixed anion and cation resins in a single unit tank. The raw water reportedly passes through the unit only once to give a mineral content of virtually zero. Resistances have been reported as high as 20,000,000 ohms per centimeter.

Available in flow rates from 10 to 10,000 gph, Penfield Mono-Bed Demineralizers reportedly cost less than 15c per 1,000 gallons to operate. No heat or steam power is required and regeneration of the resins is accomplished by simple gravity and displacement methods.

(1) Textile Soaps and Detergents (2) Products for Laundering

National Milling & Chemical Co, Inc
4601 Nixon Street
Philadelphia 27, Pa

"Textile Soaps and Detergents" lists an extensive line of soaps and synthetic detergents, compounded soaps, penetrants and dye assistants as manufactured by Namico for textile wet-processing needs. Characteristics and suggested uses for twenty-eight products are included.

"Products for Laundering" is the same type publication, but devoted to Namico's "Laundry Line" of pure soaps, synthetic detergents, soap compounds, water softener, break compound, alkaline detergents, sour, blueing, fabric finish, and bleach.

Use of Persulfates—A Bibliography

Becco Research & Development Dept
Buffalo Electro-Chemical Co, Inc
Becco Sales Corporation
Buffalo 7, New York (Station B)

This bulletin represents a collection of literature pertaining to various uses of persulfates. The references, mainly taken from "Chemical Abstracts" and covering the period from 1907 to 1950, have been selected to show the highly diverse uses to which persulfates may be put, and to stimulate interest in this class of peroxygen chemicals.

Seven references are listed for the textile field, two for starch liquefaction, fifteen for the soap industry, and three in fur bleaching, among others.

Webber Industrial Freezer

Webber Appliance Company, Inc
Indianapolis 3, Indiana

Industrial mechanical freezers capable of producing and holding round-the-clock temperatures of as low as —160°F are described in this condensed specification bulletin.

The bulletin lists more than 45 standard models, ranging in cold chamber capacity from four cubic-foot testing and production models to 45 cubic-foot production models. Standard units are offered in the various sizes to produce —40°F, —80°F, —100°F, —125°F, —150°F, and —165°F. Among advantages claimed for Webber Freezers are: full year's warranty on any model; a patented heat exchanger, which permits closer tolerance in maintaining low temperatures and increases the efficiency of unit; compressor operation at normal head pressures; air baffle around the lid opening which permits "open-door" operation without a raise in cold chamber temperature; low, easy-to-work-out-of construction; and exclusive stabilizing loops on the expansion valves.

Celanese Chemical Catalog

Publication of the 1952 catalog, Chemical Division, Celanese Corporation of America, has been announced. The 40-page booklet, which represents extensive revisions on previous editions and has been enlarged to include a number of new chemicals, includes information on all products of the Division including aldehydes, ketones, solvents, acids and glycols.

There is considerable information on the uses and application of these compounds along with an extensive listing of physical and chemical properties. Celanese specifications are available, as well as shipping, handling and toxicological data.

Synthetic Organic Chemicals, United States Publication and Sales, 1950 (Report No. 173, 2nd Series)

Superintendent of Documents
Government Printing Office
Washington 25, D C
45c a copy

This annual report of the United States Tariff Commission breaks down the production of all synthetic organic chemicals and their raw materials for 1950, a year that saw an all-time record production of 49.6 billion pounds.

The statistics given in the final report, the thirty-fourth issued by the Tariff Commission on the industry, were compiled from data supplied by more than 570 companies. The report gives statistics on the production and sales of more than 6,000 individual items and contains a list showing the manufacturers of each. Also included are statistics on United States imports of products entered during 1950 under paragraphs 27 and 28 of the Tariff Act of 1930, which cover coal-tar intermediates, dyes, flavor and perfume materials, and other finished products. The report also gives statistics on the number of research workers employed in the industry, their average salaries, and the net and gross amounts spent on research by the synthetic organic chemical industry.

The report is made up of three major sections—chemical raw materials, cyclic intermediates, and finished chemical products. The finished chemical products are further classified according to major use as dyes, lakes and toners, medicinal chemicals, flavor and perfume materials, plastics and resin materials, elastomers, rubber-processing chemicals, plasticizers, surface-active agents, and miscellaneous chemicals.

The chemical raw materials covered in this report include tar, tar crudes, and crude chemicals derived from petroleum and natural gas.

OTS Publications

(Orders for any Office of Technical Services literature should be addressed to OTS, U S Department of Commerce, Washington, D C accompanied by check or money order payable to the Treasurer of the United States).

PB 104 795, LABORATORY EVALUATION OF THE WEAR RESISTANCE OF NONWOVEN FABRICS

This 18-page report gives a brief discussion of the nature of wear in textile structures in general and its measurement by laboratory techniques. The nature of the breakdown of nonwoven fabrics by complex mechanical wear actions is discussed, and it is pointed out that flax abrasion and surface abrasion under dry and wet conditions are the critical actions in service wear. Test procedures for measuring resistance to these actions by means of a new instrument are described, and the results obtained on four bonded fiber webs are used to demonstrate the relative precision of the methods and their capacity to predict wear resistance.—50c a copy

PB 105 478, SOME PHASES OF PERSPIRATION

This 39-page Army Quartermaster publication may be helpful and a time-saver to industry in its research on the effects of perspiration, presenting a survey of literature and patents on the causes and the effects of sweating, and measures to overcome those effects.

The references are arranged in the following groups: Effects of environment on perspiration, Effect of perspiration on fabrics, Effect of perspiration on leather, Effect of perspiration on metals and finishes, Perspiration, vitamins and nutrition, Perspiration as antibiotic and antiseptic, Composition of perspiration, Biochemistry of perspiration, and Antiperspirants and deodorants. Price—$1.00.

VOLUME 15, BIBLIOGRAPHY OF TECHNICAL REPORTS (JANUARY-JUNE, 1951)

Volume 15 is now indexed according to subject, the 13th to be issued by OTS. Volumes 8 and 9 still remain to be indexed. Copies of Volumes 15, 14, 13, 12, 11, 7 and 6 may be obtained at $1.00 each.

Each month, the Office of Technical Services releases officially through the *Bibliography of Technical Reports* additions to the 150,000-document OTS collection of foreign and domestic reports. For example, the January, 1952 issue discusses the research and development activities of the National Bureau of Standards in the feature article. 233 other reports are also listed, most of them not previously publicized.

The *Bibliography* may be obtained for 50c a copy. A yearly subscription for $5.00 includes the "Technical Reports Newsletter".

Answering Your Questions About Switzers and the Day-Glo Program

Switzer Brothers, Inc
4732 St Clair Avenue
Cleveland 3, Ohio
Available on request

The questions most frequently asked about the Switzers and the Day-Glo program are answered in this leaflet. Questions include: "Who are the Switzers?", "Are Daylight Fluorescent Articles Patented?", "Has the Validity of the 'End' Device Patent Been Tested in Court?", "What About Unlicensed Manufacturers of Daylight Fluorescent Materials Who Offer to Protect Their Customers Against Patent Infringement Suits?", "Why Must All Purchasers of Day-Glo Materials Be Licensed?", "How Can a Day-Glo Article Be Identified?", "Why Don't Switzers Include Royalties in the Sale Price of Day-Glo Materials Instead of Collecting Them From Licensees?", "Can a Day-Glo Licensee Withdraw From the Program?", and "How Does the Government View Switzer Activities?".

Esters by Glyco

Glyco Products Co, Inc
26 Court Street
Brooklyn 2, N Y
Available on request

Esters of glycerol, glycols and polyethylene glycols are covered in this 24-page brochure, which gives tables of physical and chemical specifications of the nonionic polyhydric alcohol fatty acid esters. Use data are listed for such applications as surface-active agents, emulsifiers, stabilizers, defoamers, penetrants and plasticizers in addition to descriptions of interesting applications in several fields, including textiles and detergents.

New Honeywell Literature

New literature of the Brown Instruments Division, Minneapolis-Honeywell Regulator Company, as reviewed below may be obtained by addressing the company at Station 40, Wayne and Windrim Aves, Philadelphia 44, Pa.

ELECTRONIK SCANNING SYSTEM AUTOMATICALLY MONITORS UP TO 270 TEMPERATURE POINTS

Instrumentation Data Sheet 10.0-9 describes the applications, operation and pertinent details of the new Brown *ElectroniK* scanning system for automatically measuring up to 270 temperature points. The data sheet includes full description of the unit, plus illustrations of the recorder, control and rectifier units. Duplicate chart records showing appearance of various points exceeding the set point are also illustrated.

NEW NONINDICATING PRESSURE CONTROLLER

A new nonindicating pressure controller, the Honeywell Pressure Pilot, is fully described in Bulletin 16-1. This 8-page catalog covers the principle of operation, specifications, design features, mounting dimensions, etc.

ELECTRONIC CONTROL OF BECCO J-BOX

Experience gathered in bleacheries throughout the country is consolidated in the four page Instrumentation Data Sheet No 8.2-1, which outlines two versatile means of getting better bleaching at higher speeds and reduced operating cost.

ELECTR-O-VANE CONTROL THERMOMETERS

Specification sheet 609 describes Honeywell's Electr-O-Vane control thermometer models, which feature snap action electronic control.

"CAM PROGRAMMER THERMOMETERS"

This new catalog, No. 6020, describes a compact, efficient approach to the problem of *time*-temperature control. It describes and illustrates the use, advantages, technicalities and versatility of this new instrument, which reportedly combines as many as six functions from a standard-size instrument case.

NYLON HEAT SETTING

Instrumentation Data Sheet 8.4-1 describes the equipment, purpose, and benefits of controlling nylon heat setting processes. This particular sheet describes control for a gas fired unit, with qualifications of its adaptability to other machines using the same or different heating mediums.

BECKMAN INFRARED SPECTROPHOTOMETER AND DIRECT TRANSMITTANCY RECORDING ATTACHMENT

Instrumentation Data Sheet 10.16-2a describes the applicability, mode of operation and salient features of the Beckman Model IR-2 and IR-2T spectrophotometer as used with Brown *ElectroniK* recorders. Also described in the data sheet is the direct transmittancy recording attachment for the Model IR-2 infrared spectrophotometer. Photographs of the equipment, schematic diagrams of the optical system and illustrations showing typical chart records of recorded analyses are included.

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